PROCEEDINGS

Seventy-Fifth Annual Convention

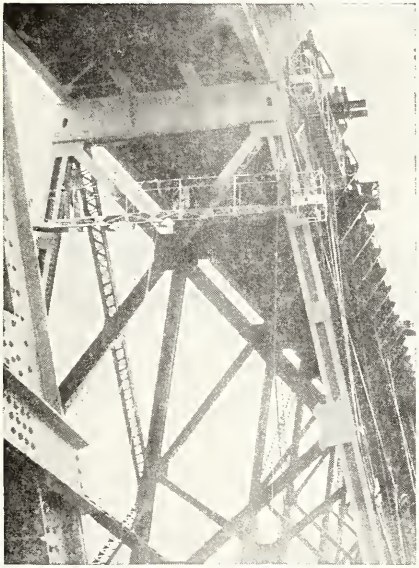
OF THE

American Railway

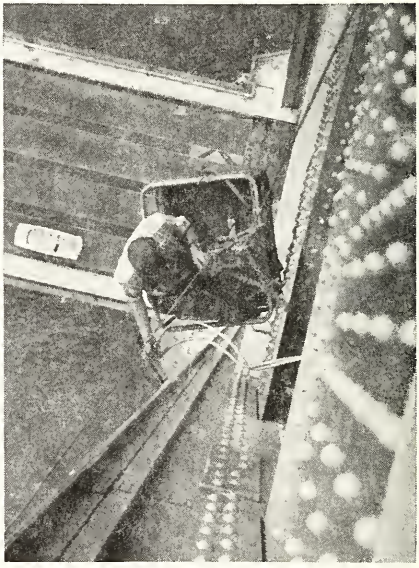
Bridge & Building Association

1970

THE HIGH ROAD—Painting as he goes this painter walks a Spider Staging along a main cable of the Chesapeake Bay Bridge.



40% SAVED—The Chicago and North Western Railroad, through the use of modern material and equipment, reduced their bridge painting costs by 40%.



FROM TOP TO BOTTOM—A bird's eye view of a Tower painter in a Spider Staging, 550 feet above Puget Sound, on the Tacoma Narrows Bridge.

RENTAL AND SALES

Spider Staging Sales Co.

P. O. Box 182 Renton, Washington 98055

PHONE: ALpine 5–8267

Proceedings of the

Seventy-Fifth Annual Convention

of the

American Railway
Bridge & Building
Association

Held at

CHICAGO, ILLINOIS

September 28-30, 1970

Published by the Association
R. E. Dove, Editor
18154 Harwood Ave., Homewood, Ill. 60430

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OFFICERS FOR 1970

J. A. Goforth ..... President
Clinchfield, Erwin, Tenn.

A. R. Dahlberg ..... First Vice President
Atchison, Topeka & Santa Fe

T. L. Fuller ..... Second Vice President
Southern Pacific Transportation Co.

N. D. Bryant ..... Third Vice President
St. Louis-San Francisco

W. H. Huffman ..... Treasurer
Chicago & North Western, Chicago

Ruth Weggeberg ..... Secretary
18154 Harwood Ave., Homewood, Ill. 60430

DIRECTORS

Term Expires 1970

A. C. Jones, Southern ..... Atlanta, Ga.

W. H. Rankin, Frisco ..... Springfield, Mo.

E. E. Runde, Illinois Central ..... Chicago, Ill.

Term Expires 1971

T. A. Reynolds, Penn Central Company ..... New York, N. Y.

J. J. Ridgeway, Bessemer & Lake Erie ..... Greenville, Pa.

J. R. Williams, Chicago, Rock Island & Pacific ..... Chicago, Ill.

Term Expires 1972

J. W. Chambers, Missouri Pacific ..... St. Louis, Mo.

R. E. Frame, Southern Pacific Transportation Co. ..... Houston, Tex.

J. C. Hobbs, Richmond, Fredericksburg & Potomac ..... Richmond, Va.

PAST PRESIDENT

W. F. Armstrong ..... Chicago, Ill.
Chicago & North Western, Chicago

OFFICERS FOR 1971

A. R. Dahlberg ..... President
Atchison, Topeka & Santa Fe

T. L. Fuller ..... First Vice President
Southern Pacific Transportation Co.

N. D. Bryant ..... Second Vice President
St. Louis-San Francisco

E. E. Runde ..... Third Vice President
Illinois Central

W. H. Huffman ..... Treasurer
Chicago & North Western

Ann Wilson ..... Secretary
18154 Harwood Ave., Homewood, Ill. 60430

DIRECTORS

Term Expires 1971

T. A. Reynolds, Penn Central Transportation Co. ..... Boston, Mass.

J. J. Ridgeway, Bessemer & Lake Erie ..... Greenville, Pa.

J. R. Williams, Chicago, Rock Island & Pacific ..... Chicago, Ill.

Term Expires 1972

J. W. Chambers, Missouri Pacific ..... St. Louis, Mo.

R. E. Frame, Southern Pacific Transportation Co. ..... Houston, Tex.

J. C. Hobbs, Richmond, Fredericksburg & Potomac ..... Richmond, Va.

Term Expires 1973

R. K. Corbett, Atchison, Topeka & Santa Fe ..... San Bernardino, Calif.

J. R. Iwinski, Burlington Northern ..... Chicago, Ill.

J. S. Pritchett, Southern ..... Savannah, Ga.

PAST PRESIDENT

J. A. Goforth ..... Erwin, Tenn.
Clinchfield, Erwin, Tenn.

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PROCEEDINGS

September 28-30, 1970

The 75th Annual Convention was held September 28-30, 1970 at the Sherman House, Chicago. For the 25th consecutive time this Annual Meeting was held concurrently with the Roadmasters' & Maintenance of Way Association, which was holding its 82nd annual convention.

Of the 2½-day convention, the first two mornings were joint meetings with the Roadmasters'.

At the opening session on Monday, September 28, the invocation was given by Dr. Kenneth Hildebrand, pastor of the Central Methodist Church, Chicago. E. Q. Johnson, president, American Railway Engineering Association, brought greetings from that organization. F. O. Johnson, president, and E. J. Powell, first vice president, Railway Engineering-Maintenance Suppliers Association, brought greetings from REMSA.

The keynote address at the opening session was given by T. D. Moore, general manager, Clinchfield, on the subject "The Challenge of the Seventies." He was followed at the rostrum by F. O. Johnson, member of the board of governors, Railway Progress Institute, who narrated a film presentation on "Make Way for Progress." In turn, Johnson was followed by J. H. MacAnanny, director—Office of Policy and Planning, Federal Railroad Administration, who chose the subject of "Public Policy in Today's Railroads" for his address. The members then met separately for the afternoon sessions.

The second joint session was held the following morning to hear an address by D. S. Bradley, vice president, electronic data processing for the May Department Stores on the subject "Life in This Changing World." Harold C. Crotty, president of the Brotherhood of M of W Employees then spoke on "Our Industry and Its Labor Relations." He was followed by Irvin P. Cook, chief engineer, Alaska Railroad, who spoke on "The Alaska Railroad" and presented a film of work on that railroad.

On the evening of the second day, REMSA sponsored a banquet for all members and their wives, which included musical entertainment and theatrical acts.

Business Session

The Business Session of the Association was held on the morning of the third day of the convention. Business include the presentation of reports by the Secretary and Treasurer, as well as by the chairman of the various standing committees.

Election of Officers

The following members were selected by the Nominating Committee, comprised of Messrs. J. W. DeValle, Chairman, R. D. Hellweg, E. R. Schlaf and R. C. Baker (all past presidents of the association), elected and installed into office:

President:	A. R. Dahlberg	Assistant Engineer	Santa Fe
1st Vice President:	T. L. Fuller	Engineer of Bridges	Southern Pacific
2nd Vice President:	N. D. Bryant	Asst. Bridge Engineer	Frisco
3rd Vice President:	E. E. Runde	Asst. to Engr. Bridges	Illinois Central

Treasurer:	W. H. Huffman	V. P. and Chief Engineer	North Western
Secretary:	Ruth Weggeberg		

For Directors with term expiring in 1973:

R. K. Corbett	General Foreman B&B&WS	Santa Fe
J. S. Pritchett	General B&B Supervisor	Southern
J. R. Iwinski	Asst. Engineer Bridges	Burlington Northern

President's Address

By J. A. Goforth
Chief Engineer, Clinchfield

J. A. Goforth

Members of the American Railway B&B Association, visitors and guests, I now declare the 75th Annual Convention of the American Railway Bridge and Building Association in session. Since our founding in 1891 this is the 75th time we have met in an assembled convention, with this being the 35th consecutive meeting in Chicago.

We might ask ourselves: "Why do we continue year after year to hold these conventions, and why do our members continue to come to them?" It is obvious that we have something our members need.

This association has a continuing responsibility to keep its members well informed and up-to-date on the latest in materials, methods and technological improvements. With the incredibly rapid technological advancements being made, the fulfillment of our responsibilities is becoming greater each year.

The period between World War I and World War II was approximately 25 years. In World War II our operations and methods of doing our B&B work had changed but little over the World War I period. Our work was, for the most part, still with manpower and hand tools. Twenty-five years have passed since World War II and look what has occurred over a comparable period. The greatest technological evolution the railroad industry has ever seen, and has included dieselization, mechanization, automation, computerization, with additional advancements in the applications of electronics. All of which makes our responsibilities even greater.

There was a time when we could explain the wonders of our age by saying: "This is the Twentieth Century." However, this is no longer the case. With the rapid technological advancements we are making, we now have to

identify with a particular decade. That's correct! We are advancing as fast in a decade as we formerly did in a century.

Just compare what we had in 1950 to what we had in 1960. Mechanization was introduced in that decade. Compare 1960 with 1970 and then try to imagine what 1980 will be like compared to the present.

The keynote address at the joint session this morning on the "Challenge of the 70's" was most thought provoking. The challenge is there and we must meet it if our Association is to remain healthy and strong, meet the needs of the times and fulfill its responsibilities. Our convention program this year is a good starter to inaugurate the "Decade of the 70's."

At this time I would like to introduce to you the Executive Board of this Association who have worked and planned to make this our 75th Annual Convention a success.

(Introduced Officers and Directors)

There are others who have worked and contributed to this Convention. Their work is acknowledged and appreciated and they will be introduced as they contribute their parts to the program. I do want to single out for special recognition the following who will not be appearing on the formal program:

Mr. M. M. Dick, Vice President and Editor, Railway Track and Structures. Merwin is a Past President of the Association and one of our most substantial members. He has headed the program committee for years.

Mr. R. E. Dove, Associate Editor, Railway Track and Structures. Bob has been chairman of the Hotel arrangements committee for years. He is a Past President and an honorary member of our association.

The behind-the-scenes work of these latter two has done much to make our conventions the success that they have been.

Association In Good Shape

Our by-laws state that "at the annual meeting the president shall present a report containing a statement of the general conditions of the association."

Our overall condition is good. Our membership as of September 27 is 709 compared to 746 members at our 1969 convention. Financially, we are in the best condition we have ever been in, due mainly to a change in our advertising solicitation. In 1969 we entered into a contract with a professional advertising agency to solicit our advertising and I am happy to report that after one year the results have been most rewarding and we expect they will improve. The treasurer's report will be presented at the business session on Wednesday morning.

Several of our long standing, faithful members have departed from us during the past year. These will be reported to you at the Wednesday morning session at which time we will pay our respects to them.

Tomorrow morning, Tuesday, there will be another joint session. On Tuesday afternoon and Wednesday morning we will conduct our separate sessions which will cover many fine committee reports and special features.

Your ladies have not been left out. A very entertaining program has been arranged for them. Tuesday evening REMSA will again host the annual banquet which will be the social highlight of the Convention. Be sure you get your admission tickets.

Treasurer's Report

Period September 1, 1969 to August 31, 1970

Balance—August 31, 1969		$ 5,552.64
RECEIPTS:		
Dues	$3,277.75	
1953 - 1957 - 1968 Proceedings	15.00	
1968 Advertising	525.00	
1969 Advertising	1,065.00	
Interest on $3000 U.S. Treasury Bills	190.57	
1969 Convention Registration Fees	6,654.28	
Miscellaneous	21.60	11,749.20
TOTAL RECEIPTS		$17,301.84
DISBURSEMENTS:		
Salaries (Secretary and Assistant)	$3,228.37	
FICA (On payroll)	143.23	
Office Rent, Telephone, Etc.	431.49	
Stationery and Printing	674.27	
Postage	626.81	
Office Supplies	112.93	
1969 Advertising	1,257.07	
1969 Proceedings	2,912.37	
1969 Convention Expenses	2,516.56	
1970 Convention Expenses	27.90	
Roadmasters' Assn. convention registration fees	2,864.98	
Miscellaneous	129.78	14,925.76
BALANCE—AUGUST 31, 1970		$ 2,376.08
U. S. TREASURY BILL DUE DECEMBER 31, 1970		3,000.00
		$ 5,376.08

September 23, 1970

APPROVED:

E. R. Schlaf, Chairman
H. M. Wilson
H. F. Lucas

Secretary's Report

Report of Membership as of September 27, 1970

ACTIVE MEMBERSHIP:		
Total Active Members, September 9, 1969		530
New Active Members since September 9, 1969		36
Reinstate—Paid back dues		2
LESS—Resigned Account Retirement, etc.	25	568
Reported Deceased	1	
Transferred to Life Membership	9	
Dropped for Non-Payment of Dues	41	76
TOTAL ACTIVE MEMBERS		492

ASSOCIATE MEMBERS:

Total Associate Members, September 9, 1969		72	
New Associate Members since September 9, 1969		9	
		81	
LESS—Resigned Account Retirement, etc.	3		
Dropped for Non-Payment of Dues	11	14	
TOTAL ASSOCIATE MEMBERS			67

LIFE MEMBERS:

Total Life Members, September 9, 1969		137	
Transferred from Active Membership		9	
		146	
LESS—Reported Deceased		4	
TOTAL LIFE MEMBERS			142

HONORARY MEMBERS:

Total Honorary Members, September 9, 1969		7	
Honorary Member added September 11, 1969		1	
TOTAL HONORARY MEMBERS			8
TOTAL MEMBERSHIP—ALL CLASSES—SEPTEMBER 27, 1970			709

Report of Auditing Committee

TO MEMBERS OF THE
AMERICAN RAILWAY BRIDGE & BUILDING ASSOCIATION:

Gentlemen:

The undersigned have examined the books of the Secretary and report of the Treasurer for the period from September 1, 1969, to August 31, 1970, inclusive and have found them to be correct as of the latter date.

Respectfully submitted,
E. R. Schlaf, *Chairman*
H. M. Wilson
H. F. Lucas

Report of Necrology Committee

1969 - 1970

To the President and Members of the

AMERICAN RAILWAY BRIDGE & BUILDING ASSOCIATION

It is with grief and regret that we report the known loss of five (5) members through death during the past year. It is possible that other members have passed away during the

year of whom we have no information. If you know of any, please report their names to the Secretary. The following have been reported since our last Annual Meeting in September, 1969.

NAME	TITLE—RAILROAD & LOCATION	YEAR JOINED	DECEASED
ACTIVE MEMBERS			
C. A. Moser	Bridge & Building Supervisor Western Pacific R.R.—Sacramento Northern Ry.—Tidewater Southern	1951	1970
LIFE MEMBERS			
M. A. Bost (Ret.)	Assistant Engineer Chicago, Milwaukee, St. Paul & Pacific Railroad, Itasca, Ill.	1935	1969
L. M. Firehammer	Bridge & Building Supervisor Illinois Terminal R. R. Co. Springfield, Ill.	1919	1970
W. V. Parker (Ret.)	General Foreman B. & B. St. Louis-Southwestern Ry. Arlington, Tenn.	1911	1970
Felix W. Truss (Ret.)	Manager Railroad Sales Armco Drainage & Metal Products, Inc. Clayton 5, Mo.	1946	1969

We deeply regret the passing of these, our fellow members. May we stand a moment in silence to honor these departed members.

Respectfully submitted,
T. A. Reynolds, *Chairman*

Report of Resolutions Committee

Mr. President, at the close of this 75th Annual Convention of the American Railway Bridge & Building Association, the Resolutions Committee offers the following resolutions:

BE IT HEREBY RESOLVED that the thanks of this Association be extended to Mr. Kenneth Hildebrand for his message of spiritual assurance.

BE IT FURTHER RESOLVED that the thanks of the Association be expressed to the several prominent speakers who gave of their time and so capably shared their wisdom and counsel with us, especially AREA President, Mr. E. Q. Johnson; The Clinchfield R. R.'s General Manager, Mr. T. D. Moore, Jr.; Member Board of Governors, RPI, Mr. F. O. Johnson; and Director, Office of Policy & Planning, Federal Railroad Administration, Mr. James H. MacAnanny; to Vice President May Department Stores, Mr. D. S. Bradley; The President of the Brotherhood M/W Employees, Mr. Howard C. Crotty; and to the Chief Engineer, The Alaska Railroad, Mr. Irvin P. Cook.

BE IT ALSO RESOLVED that the Association express its appreciation to REMSA and to REMSA President, Mr. F. O. Johnson and his staff who so generously provided us with a most splendid banquet and evening of entertainment.

BE IT FURTHER RESOLVED that our thanks be expressed to Mrs. J. A. Goforth and Mrs. F. E. Huddleston and their committees for their efforts in arranging registration and entertainment for our wives, and to the untiring efforts of the ladies who assisted in registration.

AND, BE IT FINALLY RESOLVED that the Association express its thanks to its Chairmen and their committees for their fine work in preparing the reports which were presented at the convention; also to Simmons-Boardman Publishing Corporation and its representatives for their capable assistance; to the AREA, the Illinois Central R. R., and the Chicago & North Western Ry. who provided assistance at the registration desk; to the management and staff of the Sherman House Hotel for their attentive cooperation and warm hospitality; as well as to the members of our executive committee and to our President Mr. J. A. Goforth, who has spent so much of his own personal time and effort in guiding the affairs of our Association over the past year.

Mr. President, we recommend these resolutions be made a part of the official record of this Association, and that copies be presented to all concerned parties.

Respectfully submitted,
J. C. Hobbs, *Chairman*

The Challenge of the Seventies

By T. D. Moore, Jr.
General Manager, Clinchfield

Thank you, President Goforth, President Huddleston, distinguished guests:

Some years ago, when the Coast Line and Seaboard merged, it was my job to travel the northern half of the railroad on behalf of the Operating Department, and my traveling companion at that time was one Willie. Knowing that Willie liked baseball real well, we tied up in Atlanta one night and together we went to see the Braves play. About the third inning, Willie was squirming, and finally he turned to me and said, "Captain, how much did you pay for these tickets?"

I said, "Willie they cost $5.00 apiece," And incidentally, we were in the furthest most corner of center field. He said, "Great goodness, Captain—they sure must seen us coming."

T. D. Moore

Some years ago, down in the red hills of North Georgia, a very dear friend of mine, Mr. Jim Parker, and a track supervisor by the name of Mr. Griffith, were riding on a motor car. Now you gentlemen understand what a motor car is and I'm sure you have made many miles. They were on this branch line and Mr. Parker being the trainmaster, knew that the little local freight was due. He looked off over those red hills and he saw some smoke. He turned to Mr. Griff, and he said, "Griff, I see some smoke out there." He said, "That must be that local."

Mr. Griff said, "Oh, no, Jim." He said, "That's old man Jones sawmill over there." He said, "It's been over there for years."

They went through another red cut and Mr. Jim admonished him again. He said, "Griff, I think you had better look out." He said, "I think that's that local over there. I can see that smoke. It's mighty heavy."

They went around another curve and entered this red cut and they saw this little steam engine. Mr. Jim turned to Mr. Griff, and he said, "Griff, there comes that sawmill. I'm gettin' off."

Now after this introduction by Jim Goforth, gentlemen, any of you who feel like you want to get off, you have a perfect privilege to leave.

It is indeed an honor and privilege to be able to appear before you. You gentlemen who have such tremendous influence on the construction and maintenance of modern railroad facilities in this country. Our industry is surely one of the most challenging and exciting in the world, and our progress, in my humble opinion, in the coming decade will be limited largely by our lack of imagination.

When we think of transportation that is furnished by operating the flanged wheel on the steel rail, it stirs our enthusiasm to the fullest. No system has ever been devised that comes anywhere near being so economical.

Progress Is Being Made

In order to correctly assess some of the progress that has been made in the past two decades, let us briefly consider a few of the things that have come along: Diesel locomotives, welded rail, roadway machines, radio flagging, piggyback, special equipment, automatic car identification, interline use of diesels, unit trains and modern classification yards.

These are but a few of the tremendous improvements that have been made during the last twenty years. There are many of us who believe that the advancements that were made will be completely overshadowed in the next decade.

Keep Freight Trains On Time

Let us consider some of the things involved in operating on-time freight service.

All of us will agree that we are largely in the freight-moving business; our central theme should be then that everything that points up to moving a carload of freight more efficiently is desirable. When you look at it in this light, you quickly consider that a delay occasioned by an unnecessary slow order detracts from the efficient movement of freight.

When a mechanical inspection requires an excessive amount of time and the freight train is delayed, then the freight is not being moved efficiently. Proper planning and construction of bridges so as to minimize the delay to trains will surely help us maintain good freight schedules.

Even though we are patriotic and good citizens, we are not obligated to suffer train delays occasioned by the construction of temporary trestles or other encroachments in connection with the rebuilding or relocation of some new trestle for the Interstate Highway system, or for that matter, any other governmental installation. These people must be told at the outset that temporary tracks or bridges will be built at their expense in such a fashion so as to allow maximum speeds for our trains. Intrusion onto our property by public authorities which would block up from reasonable access to other valuable railroad industrial properties must be resisted as far as is humanly possible.

With the higher speeds of our passenger trains, as well as freight, our properties will necessarily have to be improved in the coming decade. Line changes involving new bridge construction will be popping up all over the nation. Welded rail will be laid from coast to coast and from border to border. Off-track machines will be dispatched to a rough spot in the track and within minutes after its arrival, the track will be pulled and restored to its former position

Recites Hassle With College

In 1907, when our railroad was being surveyed, a line was run from Johnson City to Unicoi, Tennessee, that would by-pass the town of Johnson City and involved a distance of 9.6 miles with a compensated grade of five-tenths of 1 per cent. When this plan was brought to the attention of the city fathers, a howl was immediately set up to force the railroad to build the new line through the heart of the little town.

As a result of this public pressure, the original plans were abandoned, and this portion of the railroad was built on a circuitous route involving 12 miles of track with compensated grades of 1.7 per cent. Not only this, but the President of the railroad at that time gave approximately 120 acres to the college for purposes of expanding its campus. The right of way for the original line had already been purchased, and the line for the new railroad had to be acquired. The Clinchfield Railroad retained the right of way for the original line from 1907 until the present time.

In June of 1969, the Board of Directors of Clinchfield agreed to let us commence the building of this so-called

"high line." We began on the north end of the project where our right of way adjoins the college campus.

During the last few years the college, which incidentally had leased a good bit of our high-line right of way, and in so doing confirmed that we were the rightful owners, proceeded to purchase property across our right of way. When we began construction, there was a great hue and cry raised by a very small group of the college authorities and students wherein they used the theme that we "were going through the campus."

Of course, the college bought property beyond and west of our right of way knowing full well that we were the rightful owners of this strip of land, and that there was a possibility that a railroad would be constructed there.

Notwithstanding that the completion of this line would eliminate nine crossings at grade and would benefit 95 per cent of the people of East Tennessee, a very small group of University people brought so much pressure on the Mayor and Town Council that we were forced to delay all construction from October 1 until November 16, 1969.

The college authorities persuaded the State Board of Education to bear the cost of surveying an alternate route which could be used in lieu of the line that our engineers had chosen in 1907. The cost of this survey amounted to approximately $35,000 and was always beneficial in proving to the majority that there was no feasible alternate route to our present High Line.

At the end of this six weeks' period, we proceeded with construction again only to be faced with an injunction obtained by the City in a local court which threatened to stop us again. This was all the more perplexing in that the City for years had displayed grandiose plans wherein the railroad crossings would be eliminated in the downtown area by other and far more expensive methods. We immediately went to Federal Court in Greeneville, Tennessee, and obtained an injunction which nullified the effect of the injunction that had been granted in the local court.

In January of 1970, two of the State representatives threatened to introduce legislation and did, in fact, draw up certain bills that would force us to build our railroad in another location. Because of the possibility of their being successful in their efforts, it was necessary for us to work very hard in a public relations campaign both at home and in Nashville.

We made National Television and the report began by saying that the new railroad would be located through the middle of one of the girls' dormitories! Of course, they pointed out later that we were 200 feet behind the dormitory.

We had told these people at the outset that certain acreage on which our main line and yard tracks are now located could be sold to them if they would join us in a practical endeavor to locate a new yard a couple of miles south of the center of town. Our argument was that not only would this provide space in the heart of the City on which a wide boulevard could be constructed leading from the downtown area to the college campus, but it would make available considerable acreage immediately northeast of the campus. By expanding in this direction, they would avail themselves of acreage which is relatively flat compared to a mountainous area in the opposite direction.

Finally, we attended a meeting with City, college and State authorities, and it was agreed that this would be a combined effort which would ultimately benefit all the people of East Tennessee. We are happy to report to you today this railroad is nearing completion and we hope to begin operating trains over this new line by mid-October.

Must Attract Young Men

One of the crying needs in the industry today is the establishment of a

program that will attract top-flight young men. Certainly, there is nothing magic about a college education, but I am sure that all of you will agree that the railroad industry is not attracting nearly enough educated young men. Surely our great industry has lost none of the glamour that it presented at the turn of the century, but instead the attractiveness of our position should have materially increased.

We are able to and are offering a far greater variety of services than we were just twenty years ago, and we must initiate programs that will appeal to the young graduate. If for no other reason than the fact that other industries are attracting this type of people, we must ues every effort to hire more young men of this caliber or else we will be left far behind.

We have been told that these young men are frightened away when they learn that railroad officials are on duty 24 hours a day, seven days a week. They can launch careers in other industries that will allow them to work 40 hours a week and enable them to enjoy a long weekend from Friday afternoon until Monday morning. Somehow, we must convince them that the rewards to be gained from maintaining and operating a smooth transportation service are far more satisfying than all the leisure time they might be enjoying in some other field of endeavor.

Should Perform All Services

We are going to insist that we be allowed to perform all types of transportation service from the river to the sky. If the customer requires a short haul for his goods, we must be in position to furnish the necessary vehicle for this type traffic. If he has a carload of freight to move from Chicago to Miami, then we must be able to give him the efficient service in transferring these goods between these two points.

Of course, the fastest and cheapest way to move freight for such distances is by means of the flanged wheel on the steel rail. If it is to the customers' advantage, then we should be allowed to barge a carload of freight to any accessible point. When the quickest available service is needed, we contend that we should be allowed to fly high-class freight to any point in the nation. A unified effort must be made by the industry to insure that we will be able to offer an integrated form of transportation at the earliest date possible.

We need more people in top-flight positions in the industry who are willing to go out on the property and learn more about what is happening. It has long been our contention that the successful railroads in this country are managed by men who know operating conditions and who realize when freight is being moved as it should. With the knowledge of the amount of time required to classify and build a train in a certain yard and the running time needed between two points, the successful executive can do the necessary to correct failures in on-time operation. This cannot be done by sitting in an airconditioned office eight to ten hours a day. We have to get out on the property and get with it.

Let us check some of the many items involved in the consistent on-time operation of a fast-freight train. In moving from Chicago to Miami or Chicago to Los Angeles a cut-off time must be established in Chicago which involves the time this train *must* leave the terminal. This means that cars from interchange, cars from industries and cars from connections will be delivered in the yard and classified and the train built so that it can depart on its advertised leaving time.

Again, anything that delays the on-time departure of this crack train will be investigated and sufficient handling given to eliminate this failure. Once this train has departed its initial terminal, it must be given the railroad. If it is going to the West Coast on its advertised time, it cannot stand on a siding for 10 to 15 minutes on each division and wait for an extra east. Of

course, there might be occasions when there are "stand-offs," that is to say this train might have to wait for its eastbound ounterpart, but this should not occur more than once or twice during the entire trip.

Only Necessary Slow Orders

Unnecessary slow orders must be eliminated so that this train can maintain its schedule. Roadway people must be told again and again that the on-time movement of this train is the very life-blood of the Company, and no slow order will be tolerated unless it is absolutely necessary. It was our unhappy experience to ride a certain division several years ago and upon asking why the train was moving so slowly for such a long distance we learned that there were several slow orders that kept the speed reduced to 20 m.p.h. for a distance of some 11 miles. A couple of timbering and surfacing gangs, a bridge gang and one or two other organizations were all located in this one area. You can well imagine what these delays did to the train movements on this high-speed territory.

Yet, this slow-order business is a two-way street. Transportation officers must work with roadway people to insure that they get maximum on-track time even to the extent of changing the schedules of second class and extra trains where possible.

Signalmen will know about this crack train and will not be testing signals so that some signal might display a restrictive indication and thereby delay it.

Fast Trains By-Pass Yards

At intermediate yards, a system will be established that will enable fast freight to by-pass them. If the volume is available, then the necessary moves can be quickly made that will allow the handling of a pick-up and set-off at certain points. We know of one particular intermediate yard where cars are removed from a fast freight and cars are added and the train consistently leaves this yard in less than 20 minutes. As soon as this train stops, and it is stopped astride a crossover, a yard engine comes upon the main line, couples onto the rear and pulls off from 30 to 50 cars. It is not necessary to move this cut for a distance of over three to five car lengths until the cross-over is cleared, the switches are lined and another switch engine shoves the pick-up through the cross-over onto the main body of the train and the coupling is made. Incidentally, while the switching is being done, the locomotives are fueled. This train leaves this terminal and does not stop for a distance of approximately 300 miles. There is a crew change about halfway to the next big terminal, but this is done while the train is moving at a speed of from 2 to 3 miles m.p.h.

When this train arrives at intermediate terminals and at its final terminal, the inbound cars must be switched and delivered to the consignee as quickly as is practicable. It has long been our contention that while the customer is certainly interested in the quickest mode of transportation possible, he is far more concerned with a *consistent* delivery of his freight. If he can order a carload of freight from Chicago on Monday and know that it will be placed at his warehouse in Miami on Thursday morning, then he will ship by rail. Gentlemen, this isn't easy, but such movements are possible and are being made.

There are some interesting by-products that will come from this type operation. Not only will you enjoy repeat business from satisfied customers, but you will find that the morale of your officers and employees will improve. They will respect the success that is engendered by the consistent on-time freight service that is being rendered by their Company.

There is no question but that there will be a resurgence of rail passenger travel in this country, and it will not be long in coming. The operation of the metroliners between N.Y. and Wash-

ington is leading the way in the rebirth of profitable passenger trains and is proving that there is a place for this type service.

Handles Passenger Complaint

Some years ago I was superintendent on a division over which 14 passenger trains were operated daily. On one occasion the general manager called early (at 6:00 a.m.) one morning and advised that we were in serious trouble because of a complaint from a passenger. It seems that the passenger, who incidentally was the No. 2 man in a large national concern, had called one of our on-line ticket offices and had been treated very discourteously. He promptly sat down and wrote our operating head office and the "fat was in the fire."

The trainmaster and I quickly visited the passenger and gave him our condolences and apologies and from there contacted the ticket agent as well as the clerks on each of the three shifts. These people were told in no uncertain terms that they were going to be checked often to see that the public was given polite and efficient service.

A few days later one of the top people in our organization came over the line and asked if the situation at this location had been corrected. With all the positiveness that could be mustered, I told him that we had "fixed" it and that we would definitely have no more trouble with this particular office. Looking back, it should have been obvious at this time that this answer did not satisfy him. However we moved blandly on to other duties thinking that the employees would cooperate and that we would not be caught in such a squeeze again.

Approximately three weeks later, the general manager called again to report another explosion in this same city, the reverberations of which, in our little world at least, far surpassed anything that had been accomplished with *atomic power*. Six railroad special agents had been dispatched to this town a few days after I was questioned the last time, and they spent 3 or 4 days, on each shift, calling this office for routes, ticket prices, etc. They had amassed a literal brochure condemning my people in several regards, and the evidence against two of the clerks was most damaging.

One of the charges is well remembered wherein the railroad policemen asked for the cost of a ticket from this point to Warner Robbins, Georgia. The reply of the clerk was and I quote, "Oh, that's over there between Atlanta and Birmingham, and I tell you what you do. You come down here, and I'll sell you a ticket to Atlanta; and when you get there, you can buy the ticket for the rest of the trip and catch the next train out to Warner Robbins."

Something Wrong Here

Now, there are several terrible things wrong with a statement such as this. The first of which involved the location of Warner Robbins, Georgia. It is not located between Atlanta and Birmingham, but between Atlanta and Jacksonville in the opposite direction than that as was told the supposed customer.

The idea that the customer could buy a ticket only part way and would have to get off the train and go to the ticket counter again enroute is almost unbelievable. Yet, this remark is a true one and in the investigation that followed this fact was well established. As a result, we installed some new faces in that ticket office as quickly as possible.

All will most likely agree that if such handling had been given each reported case of such gross, inefficient service by railroad employees then the demise of the passenger business would have been slowed considerably. Yet those of us responsible were prone to take the easier course, just as I did on this occasion. We did not dig deeply enough to really *know* that our employees were conducting themselves in an efficient

and courteous manner in their dealings with the public. Needless to say, this fiasco taught all involved a very valuable lesson.

Staff Meetings Are Helpful

In our industry every officer from the president down to the assistant track supervisor must be drawn together in a common bond that will unite as a team the people who really run the railroad. There is no better way to accomplish this purpose than to set up staff meetings so that the policy of the Company can be explained. Our kind of business is, by its very nature, one that has its operation strung out for thousands of miles across this great land, it has been our experiene that almost invariably each division on which we have worked had its own peculiar understanding of the policies of the Company. In fact, on occasion, it was almost like working for a different railroad.

Staff meetings held by executive officers not only serve to fill this policy gap, but by holding meetings in which suggestions can be made, we will avail ourselves of many timesaving and money-making ideas by listening to all our people. It will give the official, young and old, a sense of belonging and will improve the espirt de corps to the extent that the railroad will look better almost overnight. From such staff meetings have come new ideas that have revolutionized the Maintenance of Way, Maintenance of Equipment, Transportation and Traffic Departments. Overtime has been drastically reduced on some railroads to the tune of millions of dollars annually. The enthusiasm that is engendered by permitting the railroad official to set forth his ideas, either by reading a paper or by simply standing up and making a recommendation, pays big dividends.

We should have these people assemble at a central point on the railroad and keep them for a couple of days. During the daytime send them to classes where papers will be read, written by people from their own groups and let them become a *part* of your organization. At night they should be assembled on a social basis so they can get to know each other. You will be amazed at the cooperation that the trainmaster will give the bridge supervisor when they are brought together and the importance of working as a team is stressed in its proper light.

We Need Fresh Ideas

In my humble opinion, we have all been guilty of sitting on our "haunches" and crying about the inequities of competing modes of transportation for far too long. We need to come up with fresh, bright, new ideas to make our position more tenable by offering to the public more efficient and a greater variety of services.

Our situation is a challenge that will be met. The railroad industry now has a chance to right itself and in so doing set an example that will lead the way in the communities which we serve.

This must be done with people. We must return to some of the beliefs that have been fostered throughout the years in this country. Beliefs that have made this country great. Our officers should, at every opportunity, appear before groups of young people and explain the free enterprise system. By our very example and the success of our industry, we can do a tremendous amount toward preserving this great country and the freedom it guarantees. With a program that is designed to attract the right kind of people, the challenge of the seventies will be met by the railroad industry.

President Goforth: Thank you, Mr. Moore. When we pause and think what the decade of the '50's brought and what the decade of the '60's brought, and what lies ahead of us, we can see that the decade of the '70's is going to present the greatest challenge that the railroad industry has ever faced. What will it be like in 1980? It will challenge

our imaginations to think about it and it will certainly be interesting to look back upon the preceding decade.

The next part of our program, entitled, "Make Way For Progress," is a good followup for "The Challenge of the '70's." Mr. P. H. Croft, president of the American Short Line Railroad Association, will introduce the next program. Mr. Croft.

Introduction of Floyd Johnson

Mr. Croft: Thank you, Jim, good morning, ladies and gentlemen:

You have all heard about the fellow who married an identical twin. His friend said, "How do you tell them apart?" He said, "That's their responsibility."

Well, we each have assigned responsibilities and the denial of these obligations causes less than a perfect product.

It requires many harmonious elements to produce our viable industry and we depend heavily upon our supplier friends. This year we are deviating somewhat from our normal format. The Railway Progress Institute, headquartered in Washington, is the supplier's arm in our Nation's Capitol. They have created a presentation which is continually updated and shown around the country.

Our good friend, Floyd Johnson, will present to us, "Make Way for Progress." Floyd is a member of the Governing Board of RPI and has been Manager of Railroad Sales of the CF&I Steel Corporation of Denver since 1962. He is a native of Greeley, Colorado, and has a Civil Engineering degree from Iowa State University.

Following his graduation in 1949, he joined the Pennsylvania Railroad and served in various capacities in the Engineering and Maintenance Department.

He went to CF&I in 1953 as railroad sales engineer and was appointed to assistant to the general manager of railroad sales in 1960, and manager of railroad sales in 1962.

He makes his headquarters in Denver. He is a member of the AREA and the American Society for Metals.

Gentlemen, It is with pleasure we present to you Mr. Johnson.

Make Way for Progress

(Film presentation)

FLOYD O. JOHNSON—Narrator

Thank you, Howard. I would like to change my hat, if I may, and express pleasure at being here as a representative of the Railway Progress Institute. I would also like to say "thank you" to Russ Griffith in the peanut gallery for coming from Washington, D. C., to put on our presentation.

The slide presentation we are about to see was produced by RPI, telling about railroads and their problems, and has been shown in more than 150 cities in the last three years.

For those of you who may not be familiar with this organization and the work that it does, here is a brief sketch of what RPI, as it is known, is and does.

The Railway Progress Institute was founded 62 years ago as a national trade association of the makers of equipment and supplies of all types for the railroads. At present it is comprised of

F. O. Johnson

nearly 200 member firms located in all parts of the country.

Since 1967, RPI has maintained its headquarters in Washington, D.C., where it follows railroad legislation at first hand as well as maintains contacts with departments of the Executive Branch dealing with railroad industry matters. Working closely with the AAR, which represents the railroad industry, representatives of RPI testify before Congressional committees considering proposed legislation affecting the railroad and supply industries.

Without further ado, I would like to direct your attention to the screen. (Applause)

Welcome to the Railway Progress Institute's n e w (slide) presentation, "Make Way for Progress."

What sort of progress are we talking about? We mean progress for (slide) shippers who need faster, more reliable service at low cost; progress for (slide) the nation's big cities, striving to unclog traffic jams of people going to and from work; progress for (slide) people who want to ride good, fast passenger trains where they are needed; and economically justified, progress for (slide) investors, who want to put their savings to work in a sound basic industry with good growth prospects; progress for (slide) consumers, who eventually must pay the full cost of distribution in higher prices for finished products; and progress for (slide) the nation's railroads, their suppliers, and their employees, working together for higher railroad earnings. All those people have one thing in common: they all need the railroads (slide)

So what happens to the railroads is of vital concern to everyone. The railroads are (slide) absolutely essential to all of us.

The Federal Railroad Administration of DOT, in making this point, has said that 90% of all freight traffic moving on the railroads now just can't be handled in any other way.

Some Real Progress Is Made

A lot of new things have been happening on the railroads lately. In fact, there have been so many changes and improvements in recent years, that we call the (slide) industry "the New Railroads."

Let's look at some of the new things in use by "the New Railroads."

They include: (slide) new motive power units, (slide) new high cube boxcars, (slide) new electronic classification yards, (slide) automatic car identification, (slide) new tank cars, (slide) new microwave communication systems, (slide) new covered hopper cars, (slide) new big-door boxcars, (slide) n e w real-time computers, (slide) new high-speed passenger cars, (slide) new all-purpose flatcars, (slide) new air-conditioned center flow cars, (slide) new autorack cars, (slide) containers, (slide) commuter cars, (slide) trailer-on-flat cars, (slide) unit trains, (slide) new signal systems, (slide) new maintenance-of-way equipment, (slide) new refrigerator cars, (slide) welded rail, (slide) new lumber cars, (slide) new warehouses, (slide) new freight handling equipment, and (slide) new central-traffic-control systems.

Of course, new equipment and new

facilities such as we have just seen cost money – a tremendous amount of money. In the 10 years, from 1960 through 1969, (slide) the railroads spent more than 12 billion dollars on capital expenditures. That is more than the total investment in many industries.

Along with the new equipment, the railroads introduced many vigorous new marketing ideas. We hear such words as (slide) "rent-a-train," (slide) "Bee Line Service," (slide) "Super C," (slide) "The Fastback," (slide) "Big John," (slide) "land-bridge," (slide) "Mini-train," (slide) and "piggy-back."

As a result of such striking advances (slide) in technology and marketing, the "New Railroads" are now better equipped than ever before to serve the nation's shippers. And they are carrying more freight than ever.

(Slide) In 1969, they handled approximately 768 billion revenue ton miles of freight traffic, the highest in history.

(Slide) This is more than 40% of all intercity freight traffic. It is nearly twice as much as the regulated truckers –and more than 200 times as much as the airlines.

Are Taxed Unrealistically

(Slide) Let us remember, too, that the railroads handled this huge volume of business on their own property, on facilities built with their own money. And (slide) they have been contributing more than one billion dollars in taxes each year.

This includes more than five hundred million dollars in payroll taxes and an additional five hundred million tax dollars to Federal, State, and local governments. (slide)

We just can't do without the railroads. As we have said, 90% of the essential freight that they move cannot be shipped any other way, economically. It is difficult to conceive of our society continuing for very long without the railroads. Just picture food, fuel, chemicals and other products being shut off for only a day or two.

Secretary of Transportation Volpe has said the average American consumer who purchases the goods that sustain the life of his family is accustomed to taking those goods home in shopping bags. (slide) "But we must remember," he said, "that those goods are shipped in bulk at vital stages of their manufacture or processing, and that without the mass movement capabilities of our railroad system those shopping bags could soon be empty."

(Slide) If the United States is to continue as the world's greatest industrial power, we must continue to have low-cost, efficient rail transportation. This is vital to our ability to compete in world markets. The railroads must be allowed to continue to supply that low-cost, efficient movement of goods.

(Slide) Railroads are the sturdy backbone of the freight transportation system in this country. And railroads are working hard to improve service they give the nation.

Need To Do Much More

(Slide) But, in spite of this, shippers, railroad managements, and informed observers alike know that railroads should be doing much more to make service really adequate for the needs of today and tomorrow.

(Slide) To meet these needs, more than 36 billion dollars must be spent on plant and equipment between 1970 and 1980. Almost half of this amount – (slide) 18.6 billion dollars–should go for new and (slide) rebuilt freight cars. New locomotives will cost another 5.9 billion dollars. And rail and tie replacements (slide) and other roadway needs will require another 11.9 billion.

These figures were advanced in the newly (slide) announced report of America's Sound Transportation Review Organization–known as ASTRO.

The cash needed each year for these programs will go from 2.4 billion dollars in 1970 to 4.5 billion in 1980. This compares with the less than (slide) 2 bil-

lion dollars spent on the average in the past three years.

Transportation Needs Will Grow

In the years ahead, the need for freight transportation will grow (slide) by leaps and bounds, side by side with the rapid increase in population and gross national product.

The Department of Transportation estimates that by 1980 (slide) the rail roads will be called upon to carry one trillion, 100 billion revenue ton miles of freight. That's an increase of more than 43% from 1969. (slide) Economists predict a gross national product of nearly two trillion dollars by 1980. That's doubling the present (slide) GNP in a decade. By the year 2000 we'll have over 335 million people in this country, needing homes, automobiles, food, clothing, and all the other goods and services which are part of our rising standard of living. (slide)

Inevitably the railroads must carry most of the increased freight load which will be thrown on our national transportation system by that growth in population and GNP. Our new super-highways — (slide) are already super-congested. Our new airports and airways— (slide) are becoming saturated, as anyone who has recently flown between our big cities knows only too well.

Are we overlooking the opportunities of the *existing* railroad system (slide)

Capacity Can Be Increased

The railroads' carrying capacity can readily be multiplied three or four times, without dislocating or inconveniencing hundreds of thousands of Americans.

It can be done with relatively low overall investment by simply running more trains, over existing right-of-way, upgrading to handle the heavier traffic. (slide)

So railroads, of necessity, are the "Way of the future" for freight in the United States. In a few short years, they will be required to haul tonnages undreamed of in the past.

(Slide) To be prepared for this job, the railroads need a massive infusion of capital to buy more equipment, and upgrade their rights-of-way and other facilities.

The billions of dollars already spent have given us a much improved railroad system for the needs of today. But many millions more will be required to get today's railroads in shape for the needs of tomorrow.

(Slide) Where is the money coming from? The first place to look, of course, is at the railroads' own earnings. Unfortunately, here we find a very dismal situation. The rate of return on investment after depreciation, in the railroad industry hit a "rock bottom" (slide) 1.88% for the 12 months ended June 30. This was lower than for any time since 1938—32 years ago. It also was far below the 2.45% rate of return for the 12 months that ended June 30, 1969.

(Slide) By comparison, the 500 largest industrial companies averaged 11.3% in calendar year 1969. With that sort of earnings record, it's a wonder that the railroads have managed to squeeze out as much money as they have for capital improvements.

(Slide) Obviously ways must be found to raise that rate of return, so railroads can continue to improve their plant and service to shippers.

Some Changes Are Needed

In order to serve the nation better in the future, we believe the railroads urgently need these things: (slide) Government support for passenger service required by public agencies . . . Government help to add new rolling stock to the nation's fleet. Elimination of unfair taxation . . . Acceleration of merger decisions in the interest of greater efficiency and lower costs . . . Freedom to diversify into other modes of transportation . . . A new government agency to regulate all modes of transportation with equality . . . Even

stronger incentives for capital investment . . . and modernization of work rules.

One way to raise the railroads' rate of return is to eliminate the huge deficits they have (slide) been forced to absorb in recent years on passenger trains. This deficit was more than (slide) two hundred million dollars out of pocket loss last year. The American people have shown that they simply prefer other means of intercity travel.

(Slide) In 1969, for example, almost 89 percent of all intercity travel was by highway; almost 10 percent by airplane; and only 1.0 percent by train.

The railroads should not be forced to assume the huge deficits in passenger operations that are resulting from this situation. There is legislation pending in the Congress which would provide a measure of government assistance to help lessen this burden on the railroads.

(Slide) And in the field of freight movement, where a car shortage exists, the Federal Government should help inject new freight cars and locomotives into the fleet.

(Slide) Such government assistance would not be an expenditure but rather an investment, in which the funds—really seed money—would more than pay back the cost to the government over a period of time.

(Slide) The Congress might charter a non-profit corporation charged with supplying a "free-running" fleet of general purpose freight cars for use nationwide. This fleet could be directed at reducing year-round shortages, but could also help to meet peak seasonal demands

Need Tax Relief

Another way to help the railroads' rate of return is to (slide) eliminate unfair estate tax assessments by state and localities.

In more than half the states, the property of common carriers is taxed at a much higher rate than other property. Since the railroads own far more property than their competitors, they are hit the hardest.

A recent Senate Commerce Committee report said flatly—"In the last 9 years, the railroads alone have been assessed (slide) more than 900 million dollars in discriminatory taxes."

Senator Magnuson, Chairman of that Committee, and other senators sponsored legislation which passed the Senate to outlaw such discrimination as an undue burden on interstate commerce. We must now work for and achieve passage of this legislation in the House as quickly as possible.

The railroads are also handicapped in (slide) another area—intermodal diversification.

Shippers could realize great economic benefits. (slide) if the railroads were allowed to become overall transportation companies—furnished transportation by rail, air, highway, or waterway—using each mode to the best advantage.

It would make sense if railroads could invest where they could (slide) put their transportation know-how to work; that is, in other forms of transportation.

But this is not possible under present laws, as they have been interpreted by government agencies. We must see to it that these laws, and interpretations, are changed for the good of shippers, railroads and consumers.

In another important area, the railroads (slide) have had great difficulty merging in their own field.

Some have been trying to merge for years, and the final decisions are still not in sight. Delays of this kind tie up capital, waste valuable management time, and create needless uncertainty.

Are No Longer A Monopoly

Although railroads are competitors in the real market place, they are treated as a 19th century monopoly in the eyes of the law. This results in burdening the consumer with high-cost and inefficient transportation.

(Slide) The President, in his Eco-

nomic Report to the Congress in February of this year, points out that the original justification for regulation, that railroads were monopolistic, (slide) has lost validity. Thus a new agency should be created to regulate all modes of transportation with equality. Promotion of specific modes should be removed from the regulatory function. Instead, freedom of pricing and experimentation should be encouraged. If lower rates are called for to attract new business (slide) or to retain present traffic, railroads should be permitted to drop rates to whatever level results in improved earnings. If higher rates are required to meet higher operating costs, they should be allowed automatically, up to a maximum of six percent a year.

(Slide) In other words, what we need, really, is a complete reappraisal of how government is going to regulate transportation.

(Slide) As we have indicated, the railroads have made massive strides in modernization in recent years but in their own judgment they ought to be spending substantially greater sums. It is imperative that capital relief for railroads be found in addition to that which was included in the Tax Reform Act of 1969.

(Slide) While the provision for five-year amortization of rolling stock, including locomotives, is helpful, more relief is a must. Such relief should allow the railroads the option of writing off for tax purposes their very heavy investment in railroad gradings and tunnel bores.

(Slide) Compounding the capital shortage problem is the fact that about three billion dollars in railroad debt will come due by 1975. A substantial portion of this will have to be refinanced at interest rates undreamed of a few years ago.

More Capital Is Urgent

(Slide) Clearly the railroads still need substantial help to get enough capital to continue the job of modernizing the nation's railroad system. The need for capital was dramatically emphasized in the current reorganization of the Penn Central, the nation's largest railroad. Action must be taken, and taken as soon as possible to avert comparable misfortunes with other railroads.

It must be (slide) noted, however, that while the difficulties of some rail carriers have had major ramifications for the industry, railroads in general at present face no critical problem of cash liquidity. However, their future is in jeopardy unless the relief we have mentioned in these areas is forthcoming.

(Slide) Passage by Congress of a loan guarantee bill would provide both stop-gap aid to these railroads with a liquidity problem and at the same time help improve the general image of railroads in the financial community by demonstrating that the Government is ready to assure that all railroads can remain in good financial health.

(Slide) We have talked about passenger train deficits, government help to modernize, unfair real estate taxes, quicker merger decisions, freedom to diversify into other modes of transportation, a new government agency to regulate all modes, and additional investment incentives, as problems which must be solved if the railroads are to generate more capital for continued modernization.

The need for action is now because the railroads' rate of return will continue to erode as operating costs mount.

Labor Costs Are High

(Slide) As is well known, the main reason expenses are so high, is the tremendous cost of labor. Payroll costs, including fringe benefits, account for nearly 65 percent of railroad operating expenses—nearly two-thirds of every dollar.

In comparison with other industries, the railroad labor content is far greater (slide).

In the 16 years from 1953 to 1969,

the industry reduced its labor force needs by half—from 1,206,000 to 578,000. But the total cost increased from 5.6 billion dollars a year in 1953 to 6 billion dollars in 1969.

(Slide) How can you reduce the work force by half, yet increase your labor cost? Part of the answer lies in wage and benefit increases every year or so.

(Slide) But another part of the answer is the need for improvement in the relationship between labor and management governed by Federal statutes which have tended to give a substantial advantage to labor.

Need Changes In Existing Laws

Congressional revision of the Railway Labor Act is needed to provide effective arbitration or labor-management disputes, regardless of the specific matters at issue.

(Slide) Another Congressional need is revision of the Railroad Unemployment Insurance Act. The railroad industry is the only industry in which strikers—and those refusing to cross picket lines—received tax free unemployment benefits almost from the day the strike begins for a period which could be as long as two years, from a fund financed entirely by the railroad industry.

Discusses Work Rules

Another factor peculiar to (slide) the railroad industry are work rules which make it so difficult for railroad management to cut labor costs and improve efficiency.

(Slide) Consider the case of the "Super C," the Santa Fe's high-speed, all-piggyback freight train between Chicago and Los Angeles. During that trip, 18 different crews in 36 hours (slide) are required under the industry's contracts with labor. In addition, under these same contracts, the crew draws one basic day's pay for each 100 miles of this 2,000 mile run.

(Slide) We must modernize work rules left over from the last century, and adjust the size of crews, to present-day conditions and equipment.

(Slide) The railroads are working hard with the unions on this problem.

We must convince the leaders of the unions that they can serve their memberships (slide) best by getting together with railroad management to work out new arrangements which will assure the economic health of the industry and its employees. And most importantly, we need Congressional action to help obtain lasting solutions to these labor-management problems. Action on all the other fronts we have discussed, may not generate (slide) enough profits—and thus cash flow—to build the superrailroads our country must have tomorrow.

Some experts on railroad affairs are already discussing other—more drastic remedies.

How Can This Be Financed?

(Slide) Some say that only the Federal Government can afford the required multi-billion dollar rebuilding job.

(Slide) Others, such as Secretary Volpe, talk of a transportation development trust fund, which would finance improvements in all modes of transportation.

The government has spent billions of dollars in recent years on (slide) highways, airways and waterways. In 1968 alone, the Federal government spent 4.6 billion dollars for highways; 1.3 billion dollars for airports; and 397 million dollars for waterways. It spent 2 million dollars for railroads, mostly for high-speed passenger demonstration projects.

The Penn Central, long before its reorganization, already had invested more than 54 million dollars of its own money in the Northeast Corridor project. (slide)

The time has come to re-examine these priorities, in the light of tomorrow's needs.

The experts agree on one thing: the railroads must have a massive infusion of capital, however it is generated, if they are going to survive and prosper in the years ahead. Economically healthy railroads are absolutely essential to everybody in this room, in this city, and state and country. And they are absolutely essential to our military security as well. How could needed shipments of arms and supplies be moved without the railroads? (slide)

What is in the future for the railroads? We share the view that there may be clamor and crisis. But almost all major change comes from crisis.

We have hopes that railroads soon will enter a new golden era—perhaps not immediately, but soon, and definitely, and for real. Change is on our side. We must keep our perspective and redouble our efforts to find ways to be increasingly useful to the people of our great country.

(Slide) Let's "Make Way for Railroad Progress." Thank you.

President Huddleston: Thank you, Mr. Johnson. Your address and the films were very impressive and instructive and I think it tells us a lot. And we should bear all this in mind because we are going to be dealing with these figures in the future excepting they will be more astronomical, I'm sure.

To digress for a moment, I would like to go back to Mr. Moore's address. There was one little key sentence there. He said, "The maximum on-track time must be granted the maintenance of way people." So I think each and every one of us should extract that and dispatch it by wire back to the vice presidents of operations because evidently the word hasn't gotten down yet.

Introduction of Mr. MacAnanny

At this time I would like to call on Mr. Croft, President of the American Short Line Railroad Association, to introduce Mr. MacAnanny.

Mr. Croft: Gentlemen, the Department of Transportation was created by an Act of Congress in April, 1967, and within this Executive Branch of the Government is housed the Federal Railroad Administration. As time goes on we'll become more familiar with the FRA.

The Office of Planning and Policy is a vital component in the Federal Railroad Administration. Heading up this important Department is Mr. James H. McAnanny.

Mr. MacAnanny holds a Bachelor of Science Degree in Mechanical Engineering from John Drew University in Arkansas. He has enhanced this degree with further study at Johns Hopkins University in Baltimore and the Harvard Business School.

After Naval service in World War II he became technical trainee with the B.& O. and subsequently moved up through assistant train manager, train manager, superintendent, and in 1962 was made general manager and general superintendent of transportation on the B.& O. in Baltimore.

In 1964 he was named assistant vice president of planning for the B.& O./C.& O. And in 1966 he was manager of transportation for the Central Railroad of New Jersey.

In 1967, with the newly created Federal Railroad Administration, he went on board with them as consultant. In 1968 he was made acting director of the Department then called Office of Planning and Policy Analysis.

He has now a career appointment as Director of the Office of Policy and Program Analysis.

Jim's talents, his abilities and his accomplishments are many and being an associate with him in Washington, it is with great pleasure I present to you Mr. James H. MacAnanny. Jim. (Applause)

Public Policy in Today's Railroads

JAMES H. MacANANNY
Director—Office of Policy & Planning
Federal Railroad Administration

J. H. MacAnanny

Thank you, Paul.

My wife and I were coming back from the eastern shore of Maryland last night. We waited an hour and a half to get across the bay bridge. Some of you are familiar with the fact they have single-track operation at various times of the season. She looked down at today's program and she said, "Hey, let's change our name." I didn't quite grasp what she was saying. I looked at the program and sure as heck it looks like somebody spelled my name with spaghetti. I just wanted to remind you that there is a capital "A" in there, it's a Scotch name, and a little Irish mixed in.

My subject today is a back-up to what you have just seen. There is a lack of policy in today's railroading. And I think there are some cynics who might find it ironic that a representative of the federal government would choose as the topic of his talk, "Public Policy In Today's Railroads."

They might contend with a certain amount of truth that you can't talk about something that doesn't exist. And I'll be the first to agree. There is no comprehensive piece of paper floating around spelling that policy out. That is, "What is the government position on railroads relative to the total transportation network?" But in my own defense, I hasten to add that the key word in the title is "Today."

Although it has been true in the past that public policy towards the railroads could be characterized as concerned negligence, I think we are moving into a new era of enlightenment where we realize the essential role the railroads must play in creating a balanced transportation system for this country. And instead of simply drafting policy statements, which is a very vital necessary first step, we are determined to do something concrete to help the railroads fulfill that role.

Unfortunately, we tend to take people and things for granted and only in times of crisis do we realize their real value. The railroads are no exception. This country's romance with the airplane, the truck and the automobile fostered a naive national belief that new forms of transportation had been developed which could eventually supplant the railroads. But, now the flush of enthusiasm has dissipated and the nation finds itself inheriting a somewhat distorted, unbalanced national transportation system—a product of myopia, indifference and unresponsiveness to the total transportation needs of all the people.

In the meantime, of course, the financial and physical health of the rail industry has declined, so much so that we hear very pessimistic assessments of its future.

The Penn Central financial situation is symptomatic of an expanding condition extending throughout the entire industry. If this trend is to be checked, all of us will have to come up with some meaningful solutions, if we indeed are to strengthen an industry that is, and certainly should continue to be, one of our national assets.

In time of crisis, of course, the perennial cry of nationalization is raised. But this, in my view, is not a public responsive solution. It is only a political solution when other efforts fail. I do not feel such efforts have failed; but rather most of them have just never been tried.

For a few minutes, I would now like to tell you about some of the approaches we in FRA are taking to help pump some life into the industry and to restore its competitve position.

The poor financial condition of the rail industry is reflected in many ways, the most obvious of which is the inability to invest funds in its total plant, including necessary safety programs. The drain of available cash resources has been caused by deficit passenger-train services, deficit freight train services, and some deficit management services.

Bills Sent To Congress

So, we aimed legislation at two of the most immediate problems (safety and passengers), which besides hampering the railroads, also adversely affect the public posture of the industry.

In the last week, we have received encouraging news from Capital Hill on both pieces of legislation—the rail safety bill has passed a conference committee of both houses of Congress where differences were ironed out. The bill to establish a national rail passenger corporation has passed the Senate and has been approved by the House Commerce Committee. So, we are hopeful both bills will clear all the legislative hurdles before Congress adjourns.

The rail passenger proposal will not only relieve the carriers of a significant financial burden, but it is designed to provide the public with a unified passenger rail service—and we hope in turn will improve the image of the industry.

Likewise, one of the main features of the rail safety bill is the authorization for an extensive rail safety research program and, with its implementation, we can see substantial benefits accruing to both the public and the industry. I believe that research can no longer be left exclusively as a carrier responsibility; witness the Federal role undertaken in other modes because of the interaction of public interest and modal safety. Yet, even under Federal involvement and funding, safety and other environment and efficiency research will take time, and full public and private benefits will not be achieved overnight.

While these programs are absolutely essential and strike at the very roots of the overall problem, there are other needs that require immediate government and private attention.

The very serious financial condition of the Penn Central as well as other roads prompted the Department in June to submit legislation which would guarantee loans to aid the carriers in meeting temporary and urgent financial requirements. It is admittedly an emergency band and type measure, but one which could forestall liquidation of essential public transportation services.

Very briefly, this legislation would authorize the Secretary to guarantee a loan only for the railroad transportation purposes. The guaranteed funds could not exceed the interest rates established by the Secretary of Transportation and would not extend beyond 15 years from the date of issuance. The outstanding aggregate amount of all loans guaranteed could not exceed $750 million, with a guarantee fee charged in connection with each loan. The Sec-

retary's authority to guarantee loans would expire five years after the date of enactment. Unfortunately, we are not very optimistic at this time about the possibilities of passage.

There is another proposal, conceived by a very important segment of the industry, that we have been asked to review. This plan would establish a $1 billion loan fund for rail transportation improvements from the reserves of the Railroad Retirement Fund. The special fund would make capital available to rail transportation companies for general improvement purposes at an interest rate slightly higher than that now paid the Retirement Fund by the Treasury for use of the money. Railroads would have a much needed source of low-cost capital for track and roadway improvements, rebuilding and repair of equipment, modernization of operating systems, and the like. The loans would be guaranteed by the Federal Government to protect the Retirement Fund against loss.

There is also legislation pending before Congress aimed at eliminating State and local tax discrimination against railroads. The Department has supported and continues to support this proposal wholeheartedly.

Must Balance Among All Modes

Yet, even though all the above measures would bring help, much more needs to be done in balancing public policy to enable the railroads to compete more effectively with the other modes of transportation—all of which receive substantial benefits from Federal Government activity.

We must seek ways to balance out Federal and state expenditures, user charges and regulations.

In 1968, for example, Federal and State expenditures for transport facilities totaled $18.8 billion, broken down in the following manner: Highways, $16.7 billion; rivers and harbors, $780 million; airports, $614 million; and airways, $699 million.

There were $77.5 million expended for the Federal urban and high speed ground transportation programs in 1968. However, except for a small amount of intermodal funds, there has been little expenditure of Federal funds for railroad programs. This vividly portrays what the absence of public policy in railroading results in.

Moreover, the railroads—as investor-financed private enterprises—provide almost entirely for their own facilities and pay property taxes on their rights-of-way, while such ways for carriers by highway, airway and waterway are provided by public funds. And, although the government objective in recent years has been to increase user charges for the other modes, a mode using facilities initially provided by the Government retains enormous advantages.

The extent of economic regulation is another indication of imbalanced governmental activity in transportation. Sixty-three per cent of total inter-city ton-miles are subject to economic regulation. One huundred per cent of rail and air ton-miles are regulated. However, this holds only for 86 per cent of pipelines, 36 per cent of motor carrier, 13 per cent of water ton-miles. The existence of such economic regulation both slows and limits responses of regulated carriers and it seriously affects their competitive flexibility in the market place. The weight of regulation thus falls unevenly, and especially hard on the railroads.

The nature of regulation is also disproportionate. Since the Interstate Commerce Commission Act was passed in 1887 to protect the public from powerful railroad monopolies, we also find that rail regulation has served to protect other modes as well as the public. And, that tends to stifle innovation and railroad response to market competition. Railroads have been particularly affected to the extent of not being able to expand into other modes; prevented from relating rate changes to increased costs; and forced to compete under the handicap of archiac rate-mak-

ink rules. However, a note of caution must be expressed here in question form. What are the public benefits from railroad deregulation, and for that matter, have railroads' benefits been fully documented?

Have Perennial Freight-Car Problem

If all of us are serious about creating a balanced transportation network—and we are—we must address ourselves to all problem areas, one of which is the perennial freight car supply problem. And, believe me, I don't use the term "perennial" loosely. We are reminded every time we go to Capitol Hill that ICC Docket No. 1 (1889) dealt with the freight car supply problem. And we are also reminded that the problem —81 years later—is still with us.

In our view the main cause of the problem is poor utilization of the existing car fleet and, therefore, from a-dollar-and-cents standpoint, utilization of equipment must improve. Overall in the past ten years, freight car utilization has improved 22 percent to an annual rate of 6,453 ton-miles per ton of capacity. However, over the same decade, the cost of new cars has increased to such an extent that freight revenue generated per dollar of net car fleet investment has decreased more than 30 per cent. Said another way, each dollar of net car fleet investment generates only $1.00 return, down from $1.50 years ago.

A related cause of car shortages is that the railroads have never been able to have sufficient cars available to meet seasonal peak demand from such industries as grain and lumber. The existing rate structure doesn't make this profitable, but one must wonder if it shouldn't be made to.

What is Being Done

So really then, it is a multihead problem. But, complicating its definition doesn't solve the problem. What are we doing about it?

First, we intend to sponsor a conference late this year that hopefully will lead to improvements in freight car supply, utilization and distribution. We expect a broad attendance of shippers, railroads, government, consumers, labor and other interested parties to pool their knowledge and come up with some solution. This approach has worked extremely well in the safety and grade-crossing problem areas.

Second, the Department worked with the Treasury Department to obtain the five-year fast amortization provision for railroad rolling stock in the 1969 Tax Reform Act as an incentive in increased equipment purchases.

Third, we have underway a research contract to determine the costs of freight car shortages for the grain, lumber and plywood industries and to develop a method of forecasting freight car needs by region for those industries.

We have also supported specific proposals before the ICC which we feel will improve freight car utilization. Probably the best example here is Illinois Central's "Rent-A-Train." It gives substantial incentive to both the railroads and shippers to improve car use. It forces—in a sense—the railroads to do what they can do best: Provide the country with a vital low-cost ton-mile alternative.

We are also exploring other ways to help the railroads improve freight car utilization. First, eliminating little used interchange points which delay cars. Second, settling per diem charges on an hourly rate basis instead of once every 24 hours. Third, increasing industry-wide use of computerized freight car control systems to keep track of cars. Fourth, developing, through research and for railroad use, procedures for a railroad operating division to truly reflect car ownership cost in its decision making.

Depending on the availability of R&D funds from Congress, FRA also will participate in joint DOT-ICC research, including items such as freight car forecasting demand models, grain

freight car distribution systems, demurrage, per diem, and car commodification systems.

We are also assisting two recently established rail labor-management task forces, one of which is studying ways to improve service through terminals; the other, how to solve track and roadway difficulties. These groups, after consulting with shippers and other interested parties, will submit their recommendations on November 1 to the Labor-Management and Labor Committee established to help the leaders of this country—railroad presidents and railroad union leaders to jointly work toward a better future.

In our Office of High Speed Ground Transportation, R & D of advanced ground transportation systems has advanced to the test stage for the TACV and LIM vehicles, moving the Nation closer to the time when 300-mph ground vehicles will connect major cities.

Construction has just begun on the newly designated test facility in Pueblo, Colorado, where, in addition to advanced systems, procedures on conventional equipment will be tested. Of particular interest and help to the railroads is the wheel-rail dynamics laboratory which will be located at the test site. It will be made available for total industry use and should help provide helpful data heretofore unavailable.

All DOT projects, I assure you, are aimed at providing this country with better forms of transportation, for today and that will meet the demands of the years ahead. And, as I said at the beginning, the railroads are, and must continue to be, an integral part of any future transportation system, and a change in public policy is a necessary first step.

Must Stimulate Public Interest

One of your first tasks, I believe, is stimulating public interest in the railroads, helping the public to appreciate the railroad's important role in transportation, and slowly begin restoring public confidence. To accomplish this, the interest of the public must become more important in your decision making. This is how meaningful public policy is developed and how best all of us working together can make a contribution to this country's future.

All of us, regardless of our position, cannot afford the luxury of isolation. No longer can any vital industry, such as yours, sit back and remain aloof of total public needs. Only a change in public policy will restore balance in Federal and State transportation investment programs. You have got to help us help you! The clock in running down, time is of the essence. There is no question that you have a story to tell, a just cause to fight. A unified industry can put the true facts before the Nation.

The public benefits are of a strong, healthy privately owned railroad system, what it can do for John Doe and for this great country has got to be made known. Once that is done, changes in public policy are then possible.

I hope the next time we meet, I can report on what enlightened public policy has done for tomorrow's railroads.

President Huddleston: Thank you, Mr. MacAnanny, for the excellent report. But I'm sure the final chapter hasn't been written yet beacuse each and every one of us in this room is certainly going to be hearing more and more from his department.

Mr. Goforth, I would like to turn the meeting back to you for the announcements.

President Goforth: This concludes our Joint Session for today. At 1:30 P.M. we will go into our separate sessions. The Roadmasters' meet in this room and the B&B members will meet in the Executive Ballroom. Tomorrow morning at 9:30 A.M. both associations will assemble again in this room for another joint session and interesting program.

The first Joint Session of this convention is now adjourned.

. . . Recessed at 11:30 A.M. . . .

Life In This Changing World

By D. S. Bradley
Vice President, Electronic Data Processing
May Department Stores

Fred talked about the first computer on the railroads. The first computer I worked on is now in the Smithsonian Institute. So that's where I got this gray hair.

Computers is not an easy subject to talk about. I found that out in the railway industry a long, long time ago. But I'm going to try to make this fairly interesting, so don't turn me off quite yet.

Somebody sent me a little cartoon the other day in the mail and it said, "To make mistakes is human, but if you really want to screw things up, get a computer." I have done my share of that in my time, too.

I hardly need to tell you that we are —and have been—living in a rapidly changing, highly competitive business world. It is a world which offers great promise through technological advancement and scientific accomplishments.

New horizons have always meant greater opportunity for those who look ahead. A few prepare and are ready for these opportunities when the change occurs, while others are less willing to accept the fact that changes are really necessary.

Change—ever-increasing change—is a key factor in our environment and you're either with it or you're out of it. Management today requires the optimum utilization of foresight. The use of historical fact-finding in decision is as outmoded as the horse and buggy or even—in today's economy—last year's automobile.

I believe we are now entering—yes that's right—just entering an era where electronic developments, computerization and automation offer a frontier of opportunity which over-shadows many of our greatest scientific innovations.

An enlightening management today must continually strive to remain abreast of the new scientific and technological tools as they are developed. Competition today dictates this course of action, and those who falter will spend a large part of their corporate existence just playing "catch-up ball." This is the price we pay for living at today's rapid-fire pace, whether we like it or not.

Speed—greater ever-increasing speed —is the byword of our modern-day world. In our generation the four-minute mile has been broken, we've reached the moon traveling at speeds of up to 25,000 mph, computers are operating at speeds measured in the billionth of a second—to mention only a few.

As I remember it, in the railroad industry, speed and control were direct factors in providing good service and, of course, good service is a very close relative of good business. You gentlemen represent the backbone of railroading—without your great efforts, railroading cannot prosper because the condition of the rail determines the maximum *safe* speed at which a train can travel. If conditions are the same today as when I left the railroad business in 1966, you must be a very frustrated and concerned but still dedicated group. I salute you.

With the recent Penn-Central crisis, there is a big question popping up more and more often today. How big can a company get? How will management—already concerned about controlling the established goals of large numbers of men, machines and equipment—keep it from crumbling under the sheer weight of managerial burdens?

Information Must Be Had Quickly

It is my feeling that there is no limit to the size or growth of a company in the future, provided that ample thought

has been given and the necessary action taken to assure absolute management control from the *top*. To do this, we must continually strive to shorten the communications distance between the production line and headquarters.

It is no accident that most of the companies listed in the billion-dollar bracket today had their beginnings in the period around 1900. In those years America stood on the threshold of growth. The decades to come saw huge gains in our population, remarkable improvements in production machinery and the artificial stimulus of two World Wars, plus Korea and Viet Nam.

It is likely, though, that the industrial growth would have been nowhere near so spectacular had it not been for our basic inventions in (1) communications, (2) data gathering, (3) data-handling equipment and (4) automation in general.

During World War II, companies began to recognize that their communications systems were overburdened by the complexities of our modern industrial organization. Consequently, one of management's chief concerns is the problem of how to keep in touch with —and lead—large groups of people through a variety of impersonal communication devices.

The communication system in some companies actually broke down long ago. Decision making reverted to lower levels of management, problems accumulated until top officers finally became aware of the situation and then they stepped in just long enough to put out the fire. Fire fighting, or management by exception was a direct result of rapid growth and faulty communication. Top-level officers recognized this condition and the tremendous losses which were its by-products.

In analyzing the problem, the outstanding features were not the lack of information or even the slow speed with which it could be made available to management. Rather, the problem was: What could top-level officers do with data once it gets it? Too many clerks and accountants still had to analyze the data, coordinate it and calculate relationships. This is time-consuming and the results were historical records, too late for the modern-day pace and were used chiefly to measure the accuracy of yesterday's decisions.

Lightning-Fast Information Wanted

Yesterday, and in many instances today, it took days, weeks or even months for people at the top to find out what goes on in certain areas of the company. Tomorrow new mathematical techniques, simulation, lazer-beam communication systems, intra - company closed circuit TV, phonovision and lightning fast computers with voice input and output will bring central headquarters into immediate touch with sales, production, financial, maintenance or inventory problems.

With new methods of analyzing current areas of concern in centralized, coordinated bureaus using the new generation of computers at tremendous speeds, management can arrive at the decisions needed to meet new business challenges or changes in production techniques fast enough to avert losses in our fast-moving environment.

What will the management of tomorrow's industry require?

Many look at the advance of technology as reason to assume that engineers and technical people will take over at the top. Actually the reverse is more likely to occur. Tomorrow's manager will have to be well schooled in finance, sales, accounting and human relations. He will have to rely on his engineers and technical people to keep pace with the multitude of new developments in the technological and scientific fields because of the vast and complex nature of the changes which will occur in the next decade.

The workers of tomorrow must be more highly trained and better educated. Their knowledge of the industrial processes must be broader and—an awareness of the need of new methods to meet the challenges of the future

must somehow be fixed—at an early age—in the minds of our coming generation.

Let's not be afraid of automation but instead, let's step up our exploration of the great new advantages that computers and other automation equipment can give us. The future in this field will be no better than we—all of us—working together—make it.

In conclusion, automation is nothing new. It's also nothing to fear. We've lived with it all our lives; we'll continue to do so until the day we die. We'll continue to grow, to change and to expand using the tools of technology—or we'll succomb to fear and cease to grow. The day we do that, we'll begin dying and the civilization we know today will die with us.

I brought a movie with me, so you are not going to have to listen to me talk for the thirty minutes. I had seen a movie some time ago I thought might be thought provoking. I have brought it with me today. The title is also "Change." (Showed movie)

You might not agree with all of it but it does give you food for thought. Some of those figures, I thought were rather outstanding. (Applause)

President Huddleston: One little thing I would like to tell you about Mr. Bradley. Several years ago he was the president of a certain numismatic organization in a fairly large town and I was his vice president. And I also succeeded him as president. And I would sit up all night trying to figure my wins and losses and would be bleary-eyed the next morning and Mr. Bradley came out really looking sharp. I often wondered why. It was because he puts his on a computer and I had to figure mine out in longhand and it took all night.

The computer age is here and I think this address and this film were very constructive. It behooves each and every one of us, as Mr. Bradley pointed out, to get with it. The changing times are here.

At this time I would like to call on Mr. Goforth to introduce our next speaker.

Introduction of Harold C. Crotty

President Goforth: Our next speaker is associated with an organization with which we are all familiar. He is Mr. Harold C. Crotty, President, Brotherhood of Maintenance of Way Employees, Detroit, Michigan.

Mr. Crotty was born in Oregon, Wisconsin, and attended the public schools in Oregon, Wisconsin, and the Harvard Business School Trade Union Program.

He has been very active in the labor movement, having held the following positions in the Brotherhood of Maintenance of Way Employees:

Local Secretary on the C.& N.W., 1942 to 1946.

Chairman of the Executive Board with the C.& N.W., 1943 to '46.

Assistant General Chairman on the C.& N.W., 1945 to '48.

Deputy Grand Lodge President, '48 to '49.

Assistant to President of the Grand Lodge, 1949 to 1958.

And President of the Brotherhood of Maintenance of Way Employees International Union since 1958.

His other special interests and posts consist of Vice Chairman of the Congress of Railway Unions, Chairman, Executive Committee, Congress of Railway Unions.

Chairman of the Board, Labor Cooperative Educational and Publishing Society.

Chairman of the Maintenance of Way Political League and Editor of the Brotherhood of Maintenance of Way Employees Railway Journal.

Other affiliations include Director and Executive Board Member of the Union Labor Life Insurance Company.

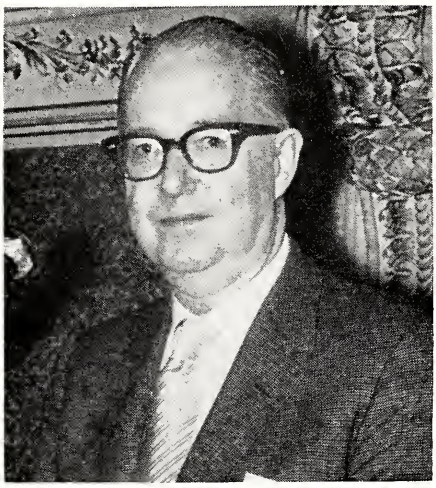
Member of the Committee on Michigan's Economic Future.

And a member of the Transportation Department Committee of the National Board of the Y.M.C.A. Mr. Crotty. (Applause)

Our Industry and Its Labor Relations

By Harold C. Crotty

President, Brotherhood of Maintenance of Way Employees



H. C. Crotty

Thank you, Mr. Chairman. I would like to particularly recognize Mr. Huffman from Chicago & North Western here, where I hold my seniority. These political jobs, such as I hold, make a man somewhat vulnerable at times and I don't want to go back down there on West Madison Street, start knocking on the door and ask to be put to work and have Mr. Huffman tell me he doesn't have a place for me. So, it's nice to see you, Mr. Huffman.

For the past three years we have had a so-called Top Level Committee, composed of leading officers of the railroad industry and representatives of certain of the railroad brotherhoods, who have been meeting periodically to perfect ways and means of advancing the industry's interests both legislatively and economically.

This special committee that I am speaking about is composed of Ed Daley, president of the U.P., Lou Menk, President of the Burlington-Northern, Bill Johnson, Chairman of the Board of I.C., Graham Clater of the Southern, Jack Fiswick of the Norfolk & Western, and Tom Goodfellow, President of the AAR.

On labor's group. Mr. Loomis, President of the U.T.U., Mr. Dennis of the Railway Clerks, Mr. Yost of the Shop Craft organization, and myself.

Now I make these opening remarks to convey to you the things that we are trying to do in order to bring railroad labor and railroad management closer together. And we meet every two months. We meet for a full half day. We have a luncheon. We know each other's problems. We have many areas in which we find mutual agreement. And I think we have taken a very important step in bringing about better understanding in our industry and in promoting its interests both legislatively and economically.

I welcome this opportunity to speak to you this morning. I feel that it is a particular privilege, because most of you—if not all of you—share with me a background of service in the Maintenance of Way Department. It is always a pleasure to me to talk to maintenance of way people, whether they are from my own organization or from the official family of the carriers, because I feel that in most respects we are on common ground and speak the same language.

As maintenance of way officials, you understand from first-hand experience, I am sure, some of the problems confronting maintenance of way workers which our organization is currently trying to meet and solve. Although it is not my purpose to discuss these problems with you in detail, they do form a backdrop to the remarks which I am going to make.

From time to time, I am afforded the opportunity of addressing groups composed of railroad officials or representatives. My topic generally relates to the areas of cooperation which exist for the mutual benefit of the railroads and their employees. This, in my opinion, is a very important subject, because I feel that in many ways the interests of the railroads and the interests of their employees are so closely interrelated that you can not draw an arbitrary line of demarcation and say: On this side of the line lie the interests of the railroads; on the other side lie the interests of the employees.

In my opinion, a form of partnership, an irrevocable partnership, exists between the railroads and their employees. The fact that this partnership is in many instances disregarded, or even ignored, does not alter the fact that it exists. My remarks today will generally be directed to what the employees have contributed and can contribute to this partnership, and what, in my opinion, they have the right to expect in return. I shall also have a few comments to make on the future of the railroad industry as I see it.

I believe you will be in almost complete agreement with me when I say that maintenance of way employees, as a whole, are as loyal a group of workers as can be found anywhere in American industry. You know from your own experience that maintenance of way work is difficult and hazardous and requires considerable training and skill on the part of the employees. You are also familiar with the extent to which heavily reduced forces on practically all railroads have added to the duties and responsibilities of maintenance of way employees. I could also put maintenance of way officials in this category if I were authorized to speak for you. You may not agree with me entirely, however, when I say that in my opinion the contributions maintenance of way workers have made to the employer-employee partnership which I have mentioned have not been met in commensurate measure by the railroads.

Perhaps I should make clear to you at this point what the workers I represent want from this partnership we are discussing—what they feel they have the right to expect.

Employees Fear For Their Jobs

As supervisory officials of the railroads, you are intimately acquainted with the revolutionary changes that have taken place in the railroad industry since the end of World War II —in work equipment, in work methods, in materials, and in the organization of the work force. This constant upheaval has naturally created a feeling of apprehension among the employees. It has unfortunately resulted in lowered morale. In the absence of reassurance from the railroads, each employee can not help but wonder: Will my job be the next one to go?

This, in my opinion, is neither a wise nor a healthy condition to exist in a partnership. We believe that it places both members of the partnership at a serious disadvantage and destroys many of the mutual advantages that should flow from such an arrangement.

I am certain that I can speak for railroad workers in all crafts when I say that one thing all of them want from their partnership with the railroad is a greater degree of stability in their job assignment than they enjoy at the present time. Workers who have spent most, if not all of their adult lives in the railroad industry want the assurance that their jobs will not be eliminated virtually overnight, and that they will not be forced to exercise their seniority at new or distant points in order to protect what they have worked for all of their lives. New workers entering the industry want at least reasonable assurance that their jobs will be permanent, and that they can make railroading a career if they choose to do so.

These are assurances which the railroad industry does not give its employees today, although we feel that this could be one of the most direct

and effective ways in which the carriers could improve not only the partnership with their employees but the outlook for the future welfare of the industry. I believe that proper employee morale is one of the most important assets of any business enterprise, and I am sorry to say I feel that this is one area which the railroads have, by and large, overlooked in their relationship with their employees.

As I am sure you know, a Presidential Emergency Board is currently investigating a dispute arising from Wage and Rules notices served in the summer and fall of 1969 by our organization and other railway brotherhoods. Among the employees' proposals is one designed to provide greater job security.

The people I represent have not had a wage increase in over a year. Obviously, they are not in the best frame of mind. So I am hoping that the sessions that will begin in Washington tomorrow will not only increase morale in our industry, bring our people a well-deserved increase in rate of pay, but it will prove an uplift in the morale that will be reflected in greater productivity, so that our industry can overcome some of the great problems that are facing it today.

Now I would like to discuss with you one element of this proposal that we put before the railroad management over a year ago. And that is something that I know is not a popular subject, but I feel I owe it to you and the people I represent to spend a little time in talking about it. That is the contracting out of maintenance of way work.

Deplores Contracting of Work

We believe the carriers could contribute greatly toward more stable employment by eliminating this practice of contracting work which could and should be performed by their maintenance of way workers. The contracting-out practice leads to a vicious spiral: The more work they contract out, the less employees the carriers need; the less employees they have, the more they are inclined to let work to contract.

As a result, the employees lose more and more work and the carriers lose an adequately-sized trained, and stable force so necessary to efficient operation.

I am making these remarks to you because the maintenance of way and structures department is one of the several segments of railroad operation in which contracting out has become of major concern to the employees on many railroads, and we do not believe that this spiraling practice is conducive to a good partnership relationship between the railroads and their employees.

I wish to make it clear that we are not, as has sometimes been contended, asking for a veto power over any and all proposals of a carrier to contract maintenance of way and structures department work, such as the construction of a general office building or a bridge over the Mississippi River, but we are trying to control this unhealthy practice. In brief, the purpose of our proposal is to obtain for maintenance of way employees, in the interest of job security, all the work coming within the scope of the agreement which they are entitled and qualified to perform. We believe the adoption of an effective control of contracting out would contribute to job security, to employee morale, and thus benefit the employer-employee partnership.

I stated at the outset of this talk that I would make a few remarks on the future of the railroad industry. I certainly do not intend to indulge in any type of crystal ball prophecy, but I would like to tell you in a general way my feelings about what the future holds in store for the railroad industry and its employees.

Future Prospects Are Good

I am not one of those who believe that the railroad industry is going to

seed and withering on the vine. I have every confidence in the future of our industry.

This nation is not going out of business tomorrow, or the day after tomorrow, and in the future our country's transportation needs will increase tremendously. The railroads can maintain and improve their position as the dominant and vital transportation medium of this country if they will plan adequately for the future, and, in my opinion, they will be passing up a golden opportunity if they fail to do so. WHY do I say this? It has been estimated that at the present birth rate the population of this country will reach 266 million by 1975. I have seen statements to the effect that in the course of time—and not too much time at that—the areas between Chicago and Cincinnati and Detroit and far to the east will become an almost continuous urban and industrial complex. We can no doubt expect the same situation to occur in other areas.

The transporting of people and goods accounts for more than 20 per cent of our gross national product—or some $170 billion per year just to keep the country moving. And the way things are going, by the end of the Seventies, we will be spending a total of $320 billion every year just in transportation costs alone.

Today we have more than 27,000 locomotives moving 1,800,000 freight cars over 208,000 miles of trackage; over 100 million vehicles roll over 3.7 million miles of highways and streets; barges and vessels ply over more than 25,000 miles of waterways; over 1 million miles of pipeline carry an ever-increasing stream of products; and a fleet of 125,000 aircraft fills our skyways.

These figures may be somewhat mind-boggling but forecasts for the next ten and twenty years are even more fantastic. In fact, the demand for transportation services of all kinds is far outstripping population growth and most other forms of economic activity in the country.

Already, we have a net increase of more than 10,000 vehicles on our highways every day. Automobile traffic volume will increase 50 per cent in the next ten years. Domestic airlines will triple passenger miles. Truck tonnage will rise 50 per cent by 1980. The railroads are accounting for 60 million additional ton-miles every day and the 10-year increase will also be an estimated 50 per cent.

Insofar as the railroads are concerned, it is my opinion that they can profit greatly if they will lay plans for the future so they will be prepared to accept a substantial share of increased business in the transportation field.

Should Not Shrink Plant

One thing which greatly concerns the employees at the present time in this partnership which we have discussed are the many proposals of the railroads to abandon, on a wholesale scale, both services and facilities. Speaking from both the short-range and the long range standpoint, and from the viewpoint of both the railroads and their employees, we do not believe the railroads can meet the needs of an expanding economy by a philosophy of contraction of facilities and services by providing less and less transportation for a nation that is going to need more and more.

It has been suggested by competent authority that the very facilities which the railroads are now abandoning or plan to abandon may, in the course of not too many years, have to be rebuilt at a staggering cost. Perhaps by the Federal Government.

Of course, I am glad to see that the railroads are at last trying to meet certain of the competition through such things as the establishment of competitive rates, the use of unitized trains hauling only one bulk product, such as coal, through piggy-backing, and through the use of tri-level automobile cars and trains and improved containerization.

The railroad industry admittedly can provide the most economical means of transportation. Its employees are the most efficient and productive of any transportation medium, and it has the greatest capacity and potential for expansion. Is it good business foresight for the railroad industry to destroy its inherent advantages of economy and capacity through a policy of contraction and abandonment? We do not think so.

Less Money Spent for Wages

The heavy and continual force reductions made by the railroads over the past ten years have deprived the carriers of much-needed maintenance work and have destroyed the jobs of thousands of workers. The commonly accepted idea that these reductions have been due to increased costs is not valid insofar as maintenance of way operations are concerned. The total payroll of the sixteen classes of maintenance of way employees represented by our organization on Class I railroads in the United States declined from $760 million in 1953 to $530 million in 1969, a decrease of $230 million. Total maintenance of way expenses on Class I railroads declined from one billion 584 million dollars in 1953 to one billion 501 million dollars in 1969, a decrease of $83 million.

These figures are from Interstate Commission statistics and present a far different picture of maintenance of way expenditures than the one that is ordinarily placed before us. They show that the reductions made in maintenance of way and structures expenditures have been far in excess of those needed to meet increased costs. As a matter of fact, if maintenance expenditures had been maintained through the years on a par with increased costs, the adverse effect on the railroads in heavily deferred maintenance and on maintenance employees in greatly reduced job opportunities would be much less.

In considering the future opportunities of the railroad industry and the ability of the railroads to take advantage of these opportunities, the present financial condition of the railroads becomes a factor to be considered. Here again, we encounter misconceptions which are commonly accepted.

It is true that there are some Class I carriers who are in financial difficulties. By and large, however, the major railroads of this country are in good condition financially. In 1969, the aggregate net income of Class I line-haul railroads in the United States was 511 million dollars, compared to 382 million dollars in 1961. In 1969, the cash flow of these railroads (net income plus depreciation and retirements included in operating expenses), which is, in essence, the cash fund available to the railroads, was one billion and 300 million dollars compared to one billion and 34 million dollars in 1961.

These figures are certainly not indicative of an industry that is about to go into wholesale bankruptcy. To the contrary, they show an industry that is in a strong financial position.

I personally view the future of the railroad industry with optimism and confidence. I believe that the railroads now have a golden opportunity to continue their number-one role as the workhorse of the transportation industry. I hope and believe that there are men of vision and foresight within the industry who will help to correct the falsely-created down at-the-heels and out-at-the-elbows image of this country's railroads, and that we will see a fulfillment of the great transportation potentialities of the industry.

In conclusion, I would like to quote from my Keynote Address to the more than seven hundred delegates in attendance at the Thirty-Sixth Regular Grand Lodge Convention of the Brotherhood of Maintenance of Way Employees, held in Detroit, Michigan, in July of this year. In referring to the partnership that exists between railroad management and labor, I stated:

"We have a common destiny with railway management . . . Together, we can build upon the firm foundation that we have already established. Together, we can help shape our industry's policy and our nation's economy. Together, we can preserve today's standard of living, which is the highest in the history of mankind, and, at the same time, plan for and help bring into reality the better tomorrow that is the goal of all of us."

Thank you.

President Goforth: Thank you. Mr. Crotty. You say that you consider it a privilege to have the opportunity to come and speak to us today. We, too, feel it is our privilege to have you appear before us. Again, thank you for coming and contributing to our program.

Mr. Huddleston will introduce the next speaker.

President Huddleston: I would like to make the announcement at this time that the last official count of registration was 700 men and 135 ladies.

Our next speaker will tell and show us some of the problems they have in Alaska. He graduated from the University of North Dakota in 1940. In 1936 to 1940 he worked for the North Dakota Department of Highways while attending college.

From 1940 to 1942, he worked for the Puget Sound Bridge and Dredge.

From 1942 to '43, with the U.S. Corps of Engineers.

Subsequently, with the Alaska Railroad, 1943 to '48 as design engineer.

1948, office engineer; 1949 valuation engineer; 1949 to 1952, assistant to the chief engineer; 1952 chief engineer.

He is a member of AREA Committee 1.

He is a registered civil engineer in the State of Alaska, a member of the Board of Engineers and Architects Examiners.

I am sure we will enjoy his comments and movie. May I present Mr. Irvin P. Cook, chief engineer of the Alaska Railroad. Mr. Cook. (Applause)

The Alaska Railroad

By Irvin P. Cook
Chief Engineer, Alaska Railroad

Thank you, President Fred, for that introduction. It is indeed a pleasure to be here but it brings to mind a quote by Mark Twain, when he said speeches are like babies, easier to conceive than to deliver.

There is nothing better that I like to do than speak about the State of Alaska, my adopted homeland.

We seem to be living at a time wherein all things are measured or related in terms of comparatives. And this is particularly true when describing the State of Alaska—our last frontier.

If a map of Alaska was superimposed on that of the United States, if would reach from the East Coast to San Diego. Alaska has a land area larger than Texas, Montana, and California combined. It is also the furthest north state in the Union. It is the furthest west, and it is also the furthest east. Perhaps you wonder how come it's the furthest east. Well the Aleutian chain extends beyond the International

I. P. Cook

Date Line, the 180th meridian, so the sun rises first on the State of Alaska. And being west of Hawaii, it also sets on the State of Alaska. Alaskans like to brag a little.

Abounds With Wildlife

The 49th State represents many things to many people. To the various conservationists, it represents the last unmarred area in the United States. Its beauty rivals any place in the world. Mt. McKinley, the highest mountain on the North American continent, rising some 20,400 feet above sea level, is surrounded by utterly untouched natural beauty — carpets of greenery, interlaced with wild flowering plants, and clear mountain streams that abound with sports fishing. It is one of the last sanctuaries where big game animals and wildlife is yet abundant.

The coastline of Alaska is double that of the South 48 states. Literally thousands of miles of coastline rise abruptly out of the waters of the blue Pacific, providing sanctuary for wild life that has been extinct in other parts of the world for many years. Miles of the coastline of southeastern Alaska rival the beauty of that of the Scandinavian fjords. With all these natural resources, the State has taken measures to safeguard them very well. They have passed laws that protect these things, not only for our present generation, but for our heritage as well to enjoy. They had an opportunity to do this that many other states did not have.

As to natural resources, consider a moment that when William H. Seward purchased Alaska in behalf of the United States in 1867 from Czarist Russia, it cost only $7,200,000, or slightly less that 2c an acre, a real real estate bargain. Its forests contain billions of feet of lumber. They have fishing banks second to none in the world. Mineral deposits containing millions in copper, gold, silver, lead, coal, and other ores have been removed. Since the purchase of Alaska, minerals worth billions of dollars have been taken to augment our affluent economy. Yet, the underdeveloped resources of Alaska stagger the imagination.

The most recent development in Alaska is the oil industry. In ten years, producing fields have already placed Alaska as the seventh largest oil producing state. Recent discoveries in the Prudhoe Bay area, well north of the Arctic Circle have an estimated 15 billion barrels of crude oil available—three time that of the east Texas field, the previous giant among United States oil fields, plus untold amounts of natural gas.

Estimates of Alaska's potential oil reserves go as high as 100 billion barrels, rivaling that of the Arabic world. One year ago this month, the State of Alaska conducted a competitive oil lease sale and auctioned off some 443,000 acres. They received fees approaching one billion dollars. One single tract of 2,500 acres was leased for 72 million dollars—the highest price ever paid for an oil lease in the United States.

Need Low-Cost Transportation

In the sub-arctic regions of the Brooks Range, minerals exist in im-

mense quantities. The major hindrance to their removal is a low-cost transportation system. We railroaders in Alaska, though few in number, feel the key to removing these treasures that nature has guarded so well, will be the extension of our rail systems. There is a study presently being made for the extension of The Alaska Railroad into the arctic totaling 800 miles of development. This study is revealing the necessity of resolving some of the most challenging problems of geology and climatology ever encountered.

Envisage unit trains of ore of 100 cars or more moving at the rate of 50 miles an hour through temperatures that never rise above 50° below zero in the winter months and may well stay down to 70° below zero for six to eight weeks on end, passing through rugged mountain terrain. This can be done, and I am sure will be done.

Many of your railroads are owned by holding companies. The Santa Fe, by Santa Fe Industries—the Penn Central by the Penn Central Company, and so forth. Although The Alaska Railroad is not as large a system as some of your lines, our holding company is without doubt the largest. The President of this organization announced last January that he would consider selling The Alaska Railroad. If any of you gentlemen are interested in copying down his name and address, and taking it back home to your railroads, I'll give it to you at this time. His name is Richard M. Nixon, 1600 Pennsylvania Avenue, Washington, D.C. Incidentally, the price is 130 million dollars, which does not include the land.

The Alaska Railroad is part of the Department of Transportation. Our Chief Executive Officer is called the General Manager, as there is only one "President" in the United States Government.

The Alaska Railroad is one of the few government ownerships wherein the cost of operation and maintenance are not borne by the taxpayer. It is a common carrier, its tariffs are filed with the Interstate Commerce Commission, not unlike your own railroads. I might add that we have the same inherent problems of management and labor as you people do.

Is The Farthest North

Several years ago, I became curious as to the geographical location of The Alaska Railroad and contacted the National Geographic Society and posed this question to them: "Is not The Alaska Railroad the furthest north complete railroad system in the world? I received a response that confirmed my belief. Although several branch lines in Russia and Scandinavia extend beyond these latitudes, no other complete railroad system can lay claim to being further north than The Alaska. The entire length of the Trans-Siberian Railroad lies well south of our southern terminus at Seward. Seward, incidentally, is one of the three points of entry to Alaska served by the railroad. The other two are Whittier and Anchorage. Our northern terminus of Fairbanks is approximately 470 miles north of Seward.

We are presently a sub-arctic railroad, subject to all the attendant difficulties of construction and maintenance that the term implies. Now we are looking forward to extending the railroad north to the Arctic Ocean, which will make it truly an arctic railroad.

The film that follows will be far more descriptive than anything I can say. After the film is shown, I will endeavor to add a few words regarding some of our maintenance problems on The Alaska Railroad.

Watch Machine Production Closely

(Movie) I will say that, since this is the Maintenance of Way Association and B & B Association, we are completely mechanized to handle both B&B and maintenance of way work. Our ratio of roadway machines is undoubtedly high when compared with your

railroads. The labor cost being such as it is in Alaska, coupled with the short maintenance season, means we must take advantage of every day.

To develop the utmost production from these units of equipment, we have established a comprehensive system of keeping records on a day-to-day basis of all phases of equipment operation. This system is integrated with our computer program, and is made available not only to management, but to line supervisors, and to the actual operators of equipment as well. Daily reports are keypunched, giving data as to hours worked, time on track, time down, fuel consumption, cost of repairs, and so forth. This method recording enables us to determine the productivity of each machine and to outline major equipment repair programs and replacement, as well as to determine the efficiency of operators, which is quite important.

The climate and geological conditions peculiar to the sub-arctic bring about problems of maintaining a railroad and maintaining service. Many miles of our railroad are built on gravel deposits that are well drained and do not create any particular problems.

However, north of the Alaska Range, constituting about one-quarter of our railroad, we encounter permafrost and it is quite a complicated problem of maintaining a true rail surface. The intrusions of permanently frozen ground from the last ice age are thawing at various rates, causing settlement that requires resurfacing of the track during the summer months to maintain service. In some parts of the railroad we resurface and realign track as often as three times a year, and these corrections must be made in the short maintenance season between June and mid September.

With nearly 24 hours of daylight in the summertime the crews can maintain track and construct bridges through the 24-hour period. To take advantage of the increased daylight, the crews sometimes commence work at 10 P.M. when the interference from trains is at a minimum, and work until 6 A.M. with all the modern track-surfacing and aligning machines and be in complete daylight, which is a distinct advantage.

During the winter months we have a totally reverse condition. On the north end of the railroad, during December and January, perhaps we have no more than four to five hours of daylight and temperatures can be hovering around 50 to 60 degrees below zero.

However, regular track maintenance and bridge construction goes on. Most of the track shimming and realigning is accomplished by extra gangs which are mobile and especially equipped for the task. Pile-driving crews function with a minimum of difficulty.

Snow Removal Is A Problem

At the same time, when we may be having the cold temperatures in the north, at our southern terminuses, where the Japanese Currents of the Pacific Ocean warm the area, we can have anywhere from 40 to 70 degrees above zero and we'll be faced with washouts and snow removal. Incidentally, the snow removal at our port of Whittier can average as much as 70 feet in a winter season.

This is the challenge that we have in railroading in Alaska. It's a frontier land, it's an arctic land, it's a land of immense wealth. And we railroaders feel that we can meet this challenge if we can extend our rail network and we are making a decided effort to extend it up in the Prudhoe Bay area where the oil development is coming along. It is bound to be an immense development. Presently there is a pipeline that will be the largest crude-oil pipeline in the western world, 48 inches in diameter that will run for about 800 miles. The cost of it is currently estimated at a billion and one-half dollars. And to keep this pipeline charged it will require some 1200 wells pumping at all times, which means there will have to be somewhere around 1600 wells in operation. And this is the first phase of the development.

I'm sure within very few years you'll see gas lines extending down through your Midwestern area and through the Eastern area from Alaska, because the availability of natural gas is almost unlimited up there, and we hope as railroaders we can contribute our part to this development.

Thank you, gentlemen. (Applause)

President Huddleston: Since most of this information on Alaska is new to most of us, and it certainly is to me, I'm sure there must be a tremendous amount of questions you will want to ask Mr. Cook at this time. We are right on schedule and we do have plenty of time.

But before you ask a question, we would like it to go into the record, so please step to a microphone and introduce yourself and name your railroad so that it will be made a matter of record. If you do not do this it is very difficult to take your question down. So, if you have any questions, I'll ask Mr. Cook to come back to the podium and remain here until all questions have been answered. Any questions from anyone?

Is An Easterly Route Feasible

Member: I wonder if Mr. Cook could indicate whether any studies have been made of the possibility of a line on the tundra coming eastward from Prudhoe Bay?

Mr. Cook: Yes, during World War II, connecting with the Canadian rail system, there was a study made, which probably was one of the things that prompted me to go into the railroad industry. Presently we have a consulting engineering firm making a study, and it's a real comprehensive and detailed one. I would guess we have one hundred engineers working on it, determining the feasibility of making this 800-mile extension.

There are some real complicated engineering problems to solve, not only in sub-soil conditions, but geographic. Through the Brooks Range, sometime during the history there was an upheaval that made a sheer wall practically through the entire range, about 800 foot differential, just right abrupt, and try to develop a railroad grade to get over that really takes some ingenuity.

Member: I would be interested in knowing whether you have any continuous welded rail installed and what particular problems you may have encountered if you do?

Mr. Cook: Shortly before the welded rail process really came into development in the United States, we completely relaid the railroad with 115-lb RE rail, so we have jointed rail. However, we do use welded rail in all our crossings and in compromising, like in switches, we use welded rail for rail joints. We will have one section, I hope, within a year or two, we have a 3-mile tunnel and a one-mile tunnel that we have to re-tie, and I'm very interested in trying welded rail through that. But our welded rail is rather limited on the railroad.

Fred J. Bossert (Supvr. Const., Long Island): How do you handle your switch cleaning during snowfalls?

Mr. Cook: We use ballast regulators, we clean by hand, and we have developed a machine called a Snow-Go. We have developed our own innovations on that and it is very good for cleaning switches. But, if you don't get after the snow right away to remove it and it becomes hard, it becomes a task that almost has to be done by hand to clean switches.

Our snow conditions vary. On the south end of our line, where it is very wet, the snow is heavy and packs. On the north end of our railroad, where it is colder, the snowfall is lighter and there it become very little problem because it either blows away or it can be cleaned off with any ballast regulator or any machine like that without a great deal of trouble.

We have tried some of these machines with blowers, using jet engines

and so forth, but not with too great success.

President Huddleston: Mr. Cook, on behalf of the Roadmasters' and Maintenance of Way Association of America and the Bridge and Building Association, we thank you for this most excellent address.

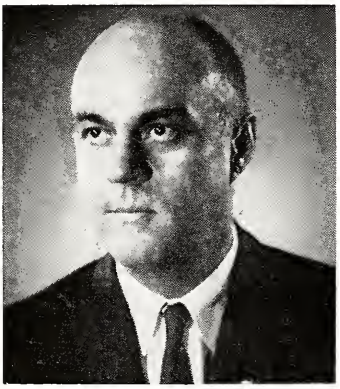
We will adjourn at this time and the Roadmasters' Association will meet here this afternoon at 1:30, I believe it is.

. . . Recessed at 11:30 A.M. . .

Report of Special Committee No. 1

Maintenance and Renewal of Tunnel Linings

J. A. CAYWOOD, Chairman
Senior Vice President, DeLeuw, Cather & Co.



J. A. Caywood

1. Introduction

Although the mining industry has been associated with tunneling for a long time, American railroads have played a pioneering role in building permanent tunnels in this country. More than a century ago, railroads started building some of the first and most difficult tunnels, such as the Alpine tunnel in Colorado, and later the tubes under the Hudson River and East River, the latter of which are still in use. The tunneling lead set by the railroads was applied in constructing tunnels for highway, water supply, sewage, subways, and so on.

Until recent years, the tunnels and lining methods found little improvement over those used in the previous decades. Because of the rapid advancements which have taken place during the last ten years future technology now aims at tunneling rates five to ten times those prevailing at the present time. Because of the improvements in excavation and lining methods, our know-how will meet this challenge probably before the end of this decade. Perhaps you are already aware of the two new tunneling techniques which promise to revolutionize tunneling in rock. One is the development of tunneling machines or moles for the so-called hard-rock excavation which was initiated in the U.S., and the other is the introduction of the shotcrete lining method which was first introduced in Europe. Shotcrete, which will be discussed later in this report, is a very versatile tool for tunnel linings and is being used with amazing success and economy for new tunnels as well as for

the maintenance and renewal of old tunnels.

The subject of old tunnels and their linings is of particular interest to railroads because these must be maintained in good condition at all times to assure uninterrupted traffic operation. The present practice in railroad engineering indicates that tunnel maintenance has not received the consideration that it deserves. This presentation is an effort toward fulfilling that gap in our information. It is the purpose of this report to summarize problems frequently encountered in the maintenance of railroad tunnels and to discuss the new methods which are available for more economical tunnel maintenance.

The term tunnel here means a bored tunnel in earth or rock and does not include cut-and-cover construction sometimes also referred to as tunnel. Most of the discussion here refers to rock tunnels which includes a vast majority of railroad tunnels.

A few words about the basic types of linings at this point are also in order. A lining is in reality a structural support system which is applied to stabilize underground openings during or after excavation. Linings are often classified as temporary linings or permanent linings—although this difference seems to be disappearing in presentday technology. A temporary lining is a support system applied usually for the initial stability during tunnel excavation while the permanent lining is a support system, applied generally as a second step subsequent to the temporary lining, for the long-term stability of the tunnel opening. For purposes of this report, the word lining refers to the permanent tunnel support structure the integrity of which must be maintained at all times for safe operation.

2. Maintenance

(a) General

In terms of the presentday systems language, a tunnel may be regarded as a system in which excavation and lining are important elements of the system. In other words, a lining is an integral part of a tunnel, and the maintenance of a lining is generally the maintenance of the tunnel as a whole. Thus the upkeep and restoration of linings cannot be over-emphasized to assure safety and uninterrupted operation of the railroads through tunnels.

It must be stated at the outset that there are no simple or set rules for tunnel maintenance. So much depends on the rock conditions, the type of lining, nature and extent of deterioration of a lining, the type of rock movement and rock falls, water seepage and so on. Tunneling technology — design, construction, and maintenance—is still, as in some other branches of engineering, largely a matter of judgment. However, a review of past experience and knowledge of new methods as presented here will provide valuable aids to judgment.

In this report three major types of linings, namely, brick, concrete, and timber, frequently encountered in railroad tunnels, are considered. Before we consider their upkeep, we must keep in mind two important factors which directly affect maintenance. One is the quality of design and construction, and the other is the quality of maintenance inspection. Since there is no such thing as a maintenance-free structure, a certain amount of maintenance is always to be expected in spite of the best design and construction. However, we can try to build maintenance out of a structure; in other words, minimize maintenance at the time of design and construction. It is a strange irony that the designers often study several alternatives to minimize initial capital cost of a structure, but rarely investigate different possibilities to reduce future maintenance. (Perhaps the designer knows that by the time maintenance becomes a serious problem, he won't be around.) Those who are directly involved in maintenance work must impress upon, or in computer language, feed back to, the designers and those responsible for con-

struction the problems of maintenance which should be considered in selecting their designs, materials, and workmanship for tunnels.

The second factor, the inspection of lining performance, is very important for railroads who have to ensure continuing good performance of old tunnels, the design and construction of which were not controlled by the present-day engineers. Careful and periodic inspection of tunnels and linings is a basic requirement.

Another important factor in lining upkeep is "preventive maintenance," or the good old adage, "a stitch in time saves nine," works very well for tunnels too. The timely discovery and correction of small defects in linings can save large costs of renewal later on. Actually, preventive maintenance goes a step further than the adage. It includes the diagnosis and correction of problems *before* they become apparent—a no small feat as the forecasting of tunnel problems requires considerable experience and judgment.

(b) Maintenance problems—Causes and consequences

Depending upon their experience, some maintenance engineers are apt to say that there are as many problems as there are tunnels. Although the variety may be endless, most of the problems can be attributed to a few basic causes depending generally on the type of lining. The basic problems associated with the linings of railroad tunnels may be categorized as follows:

(1) Brick and concrete linings.
(2) Timber linings.
(3) Water inflows and pressures.

Obviously, the deterioration of linings or the permanent support system will be the basic cause of tunnel instability. Thus the defects in a lining which impair the rock support can lead to rock falls and excessive water flows.

The following discussion indicates the common problems, causes and effects in major types of linings encountered in railroad tunnels. The problems almost in every case involve the durability and strength of the lining materials against ravages of time.

(1) Brick & concrete linings

Most common problem observed in concrete and brick linings are softening, cracking and spalling of the lining leading to such consequences as excessive water inflows, rock movements and rock falls.

Among the variety of problems associated with deteriorated linings, are those resulting from natural causes. These causes include freezing and thawing, particularly near tunnel portals, cyclic variations in temperature, presences of detrimental salts (such as sulphates) in water and rock, swelling rock, etc. In general, these causes, which are generally beyond the control of man (in this case, the railroad engineer), work over a long period of time, resulting in usually a slow process of deterioration.

Other problems may arise from man-made causes. These are due to poor materials and/or workmanship. All such problems, whether attributable to natural or man-made causes, generally lead to the same basic consequences, namely possible water inflows, rock movements, and rock falls.

At the first sign of deterioration, a careful visual observation should be made to determine the extent of softening and cracking of the lining, rate of water seepage, and deformation of the lining, if any. In cases where deterioration is marginal, testing of the linings by removing samples of the material may be necessary. Sometimes, in-place, non-destructive tests such as ultrasonic or soniscope tests are used to determine true quality of the lining. Most of the in-place tests are sophisticated and expensive and should be used with caution, as the information obtained is usually subject to considerable interpretation and may be no better than that obtained from simple tests.

(2) Timber linings

There are still many railroad tunnels with timber linings, most of which were built around the beginning of this century. Some of the timber was not treated against decay.

Most of the maintenance problems of timber linings originate from the nature of the material and its interaction with the surrounding environment, which includes water, the gases generated by locomotive fuels, and natural weathering. If timber decay is found at an early stage, it can be corrected in place by injecting a wood preservative to arrest further deterioration. For this purpose, the services of a timber specialist are required to first perform an appropriate survey and to make tests to determine the degree of decay, and then to apply suitable materials and methods to preserve the timber lining and to prevent further decay and loss of support. Timber examinations may consist of nondestructive testing or wood sampling by borings which are in turn used for injecting preservatives. The committee is aware of a number of cases in which preservatives were successfully applied in-place to arrest further decay of a timber lining.

If the decay in timber lining is advanced and extensive, the decayed portions of the lining will have to be removed and replaced by any of the modern linings, such as steel, concrete, or shotcrete depending on the economics of each type and the conditions under which these linings have to be applied. In general, it is advisable to remove the timber lining because the presence of decayed timber behind a newly-applied lining can be a serious source of instability and possible rock movements.

(3) Water in-flows

The presence of ground water makes most tunnels act as drains, which tend to function as collectors of ground water by drainage into the tunnel opening. In order to stop the drainage action of a tunnel, a sound lining with unimpaired integrity is necessary. Any crack or impairment of the lining can result in water inflows and what is termed as a "wet" tunnel.

A "wet" tunnel is not only a nuisance, but can be hazardous. Sometimes, a lining can be damaged even (if not infiltration is obvious) by the hydrostatic pressures which might be built up behind a lining. This can show up as excessive localized cracking and water seepage. In such cases, relief of water pressure should be provided by installation of a suitable drain—"weep" hole or pipe. Proper functioning of these holes is a very important maintenance requirement.

Water seepage is generally the prime cause which can result in detrimental effects and a variety of problems in linings. However, all types of water seepage may not be detrimental, as its effects will depend upon a number of factors, including the quantity of flow, location in the tunnel (roof or walls), intensity of seepage or hydrostatic pressures, sediments accompanying flow, etc. Obviously, any appreciable flow from the roof of a tunnel could lead to unacceptable deterioration if left unchecked.

Depending upon the amount and nature of flow, most water seepage can be controlled by proper drainage methods, sealer coatings, sump pumps, and grouting or a combination of these. Frequently, the determination of the point of origin or seeping rate should be kept under observation to determine if the rate of flow is increasing or decreasing. If the discharge is excessive, or if the tunnel has to be maintained in a nearly dry state as in the case of electrified railroad tunnels, grouting behind the lining and pressure grouting into rock through pre-drilled holes may be called for. Details concerning the grouting materials and methods should be planned carefully as considerable efforts can be wasted without any results. Consideration should also be given to the choice of equipment, size and depth of

drill holes, grouting pressures, additives, etc. Today, a variety of quick-set materials and additives is available which can be utilized with good advantage depending upon conditions.

(C) Corrective measures
(1) General

If a tunnel lining exhibits defects due to whatever cause, two major consequences—water inflows and rock movement, can follow depending upon the degree and nature of deterioration of the lining. Prudent maintenance would dictate corrective action as soon as the first signs of lining deterioration are diagnosed and before any major consequences appear in their severity.

If moderate water inflows appear through a cracked lining which is otherwise quite sound, pressure grouting into rock has been used with success. Depending upon the conditions of the lining, grouting should be done behind the lining to fill in any voids. Frequently, grouting slurries contain various additives to accelerate set as already indicated. The application of grouting should be planned with care taking into account the rock conditions including the characteristics of fractures, faults and joints; as much of the grout may be misdirected.

Deteriorated linings may result in lack of support and stability leading to rock movements. Depending on the nature of the rock and the lining deterioration, the rock movements may become serious rapidly and may also result in rock falls. If rock moves, or rock fall is moderate, rock bolting should be considered as an expedient or emergency measure. The cost of rock bolting is generally much less than other types of commonly-used lining.

Depending on the type of bolts, rock bolting can provide nearly permanent support. In certain applications, rock bolts have successfully provided permanent stability without need for additional lining or other added corrective measures. In such cases, tensioned, fully-grouted bolts are used. The type, length, capacity and pattern of rock bolts require the assistance of experienced persons to make their use effective.

If the water inflows and/or rock movements are excessive, then grouting and rockbolting is likely to provide partial but quick relief. In this case, more permanent (and more costly) measures, such as construction of an added lining, are called for. Obviously, a combination of rock bolts, grouting and lining will add to the cost but should be used when dictated by job conditions.

When the condition of a tunnel is such that the application of a new lining is determined to be necessary, the first step is the choice of the type of lining which will be most effective under the prevailing conditions. In most cases, the cost is the governing factor; however, in certain cases, the railroad traffic conditions may override cost considerations.

Since construction of new timber linings is now rarely done, until recently, the engineer could only choose between two other types of linings for use as corrective measure—concrete and steel. In the last few years, a fourth type of lining—shotcrete, a relative newcomer, is finding increasing use for tunnel maintenance work. These lining types for maintenance work are briefly described.

Regardless of the type of lining selected, the application of a new lining will interfere in most cases with traffic operation depending upon the tunnel usage. The cost of adding a lining will be greatly increased if traffic interruption is not to be tolerated and the work has to be performed in the short intervals between trains or at night.

Prior to the application of any lining, usually the question arises as to whether the old lining should be removed. If the tunnel clearances permit the addition of a new lining, the cost of renewal of the existing lining should be avoided provided the lining is not

badly deteriorated. Of course, if the addition of a new lining over the existing lining causes clearance problems, the old lining will have to be removed. Regardless of clearance problems, if the old lining is badly deteriorated, it should be removed prior to adding the new lining. When a new lining is placed over an old lining, grouting behind the old lining, and between old and new linings should be performed to fill in voids especially in the tunnel arch section.

(2) Cast-in-place concrete

The use of cast-in-place concrete lining in maintenance of existing railroad tunnels is limited because of cumbersome formwork requirements which greatly interfere with traffic. Therefore, unless the traffic delays can be tolerated, or traffic through the tunnel can be diverted or shutdown for certain periods, concrete lining for maintenance of large portions of a tunnel will be generally an expensive operation.

In order to accelerate cast-in-place work in tunnels, quick setting cements such as ASTM Type 111 or accelerating additives as previously indicated are often used to permit early stripping of concrete forms. The use of additives and quick-setting cements should be optimized as their excessive use can lead to detrimental effects such as shrinkage cracks, just as over-cementing of concrete will lead to similar results. Frequently, the cast-in-place concrete work is preceded by the application of steel ribs for temporary support.

In order to avoid cumbersome formwork for cast-in-place work, Europeans have successfully used precast concrete segments erected in place. The precast linings have also been used in the U.S. for new tunnels and a few maintenance applications, but widespread use has not occurred. A major drawback in the choice of precast segments is that unless a large number is needed, the cost of precast elements will be quite high because of the special fabrication procedure and forms required. Another European method introduced recently is the Bernold method in which the steel form in incorporated in the lining as reinforcement for cast-in-place concrete.

(3) Steel support

Steel supports offer greater flexibility in the maintenance of tunnel linings than concrete. Their use over existing linings causes much less of a clearance problem because of lesser thickness required. In general, where steel is used for permanent tunnel support, the hazard of corrosion must be considered. If the environment (water or rock) has a corrosion potential for steel, proper corrosion control measures such as coatings and cathodic protection should be considered. The most commonly used steel supports are ribs bent to the tunnel shape. They offer the advantage that steel ribs can be adapted to line even small portions of tunnel at relative economy. Another advantage is that steel supports can be installed readily without causing hazardous delays in tunnel work. However, a disadvantage of most steel supports (ribs) is that usually a secondary lining of concrete or shotcrete has to be applied over the steel supports. In order to avoid a secondary lining, the alternative will be the application of steel plate or corrugated liner plate which is available from leading manufacturers and which has been successfully used by several railroads. Again, economic factors should enter into the picture prior to the application of these relatively costly methods.

(4) Shotcrete

In recent years, shotcrete has achieved great success for tunnel support. It is sometimes referred to as instant lining.

Shotcrete is pneumatically-applied concrete and is applied as a spray under pressure to build layers of concrete

having structural strength. It should not be confused with pneumatic applications where no coarse aggregate is included in the mixture.

Because of the versatility, flexibility and economic advantage of shotcrete, its use is gaining rapid success and acceptance. Several tunnels came to the attention of this committee where shotcrete and a combination of rock bolts have been used for maintenance work and to prevent rock falls.

One eastern railroad tunnel which had a timber lining that had decayed resulted in some rock falls. The maintenance consists of replacement of timber sills, posts and caps with shotcrete applied (without forms) along the side and roof of the tunnel.

On another tunnel, the existing concrete lining had deteriorated and as a result, a few rock falls were noticed. Here, rock bolts were used to stabilize the tunnel. However, in a few locations where rock bolts were difficult to install, shotcreet was used to prevent rock falls.

A third tunnel in Ohio is constructed of both brick and steel-plate lining. The brick lining had deteriorated and rock movements had been noticed and which were followed by rock falls. The condition of the tunnel was aggravated by recent lowering of the tunnel floor or invert which caused instability of the lower portion of the tunnel's side walls.

Maintenance is being carried out in two stages. The first stage is the emergency maintenance consisting of the application of rock bolts and grouting behind the steel lining to fill voids known to exist. The second stage is planned to be the application of a three-inch layer of shotcrete on the entire roof and walls of the tunnel.

It is the opinion of the committee that improved shotcrete methods hold a great promise for railroad engineers in the maintenance of rock tunnels under a variety of conditions at considerable cost savings compared to those methods presently available.

(3) Renewal & new linings

If the deterioration of a tunnel lining is extensive, the correction will generally require replacement or renewal of the old lining by application of a new lining. Construction of the new lining in an old tunnel requires essentially the same material and method as those used for the lining of a new tunnel.

Until recently, the most commonly used method for the lining of rock tunnels was the installation of steel ribs during tunnel excavation followed by a cast-in-place concrete lining usually referred to as secondary or permanent lining. This is a two-step procedure requiring two linings, one after the other. The procedures for the application of steel ribs and concrete are well established and known to all concerned and need not be stated here.

However, "shotcrete," as already described briefly, is a one-step lining operation. Shotcrete can be used with advantage under a variety of rock and tunnel conditions and does not require the use of forms, unlike those needed for concrete linings. For this reason and because of lesser thickness of lining required, shotcrete lining may result in savings in cost of up to 40% (or more) compared to those involved in the application of steel ribs and concrete lining. In general, the thickness of shotcrete lining is usually about half that required of a concrete lining, and the cost of reinforcing steel, which is usually in the form of wire mesh is a fraction of that required for reinforcing steel used for cast-in-place concrete. Yet, the structural strength of shotcrete is generally equal to or better than that of concrete lining for rock tunnel support. Also, the construction time required for a shotcrete lining is generally less than that required for other types of linings.

For these reasons, the cost savings with shotcrete can be considerable. In a recent rock tunnel contract for a subway, although bids were invited with

shotcrete and cast-in-place concrete as alternative linings, all of the ten contractors offered bids for shotcrete; no bids were received for cast-in-place lining as it was estimated to be higher in cost.

A typical shotcrete lining will usually consist of a thickness of 4 to 8 in. applied in two layer of nearly equal thickness. In new tunnels, the first layer is usually applied immediately after the blasting round and while mucking is going on. This depends on the rock conditions. If the rock is sound, the immediate application can be delayed depending on the stand-up time of the rock.

Shotcrete has been quite successful in directly sealing low to moderate water inflows without the need of drainage pipes. However, excessive inflow will have to be drained or treated in a manner generally similar to that required for other linings.

A typical shotcrete mix for tunnels is equivalent to a 7-bag concrete mix plus a special additive, called an accelerator, to promote quick set (Final set: 20 minutes; compressive strength: 3 hours 600 psi; 28 days, 5,000-7000 psi). In most cases, nearly 75% of the total strength would be achieved in two (2) to three (3) days. The quick set is necessary to promote bond and to stop rock movements and rock falls. The maximum size of course aggregate is usually between ⅜ and ¾ in. Shotcrete is generally mixed in a special machine and brought in a dry state to the application nozzle under pressures of 80-100 psi. Water is added at the nozzle to prevent set of the mix in the storage tank. The spraying is usually in a rotary motion. Frequently wire mesh 6 in. by 6 in. or 8 in. by 8 in (6 or 8 gauge) is used as a reinforcement.

The cost of shotcrete will vary depending upon a number of factors, particularly the volume required for a given application. At the present time, the cost of shotcrete compares with that of concrete. However, the economy arises from lesser thickness of shotcrete required to support the same rock loads for which much greater thickness of concrete is required.

Although shotcrete nearly approaches a cure-all technique for the lining and maintenance of rock tunnels under a variety of rock conditions, it has a few limitations. If the rock at the surface receiving shotcrete application is disintegrated, decomposed, or otherwise coated with loose material, shotcrete will not bond or adhere to the surface. In other words, under certain poor surface conditions, proper surface preparation will have to be done, and depending upon degree of rock or surface disintegration, this may not be possible. Another difficulty may arise due to corrosive salts which may be present in groundwater and which may react with shotcrete ingredients, particularly the accelerating additive. In such cases, corrosion resistant ingredients will have to be used. Such tunnel conditions are unusual and, therefore, for most new linings as well as for the maintenance of old linings, shotcrete will deserve first consideration.

(4) Conclusions & recommendations

In the preparation of this report, the maintenance and service histories of several tunnels were reviewed. Based on the review and experience, this committee is of the opinion that there is need for more systematic and careful inspection of our aging tunnels and their linings in order to minimize maintenance costs and interruptions in traffic operation. Periodic, thorough inspection of the condition of a lining is not an old-fashioned thing, but a basic necessity to assure economical performance of railroad tunnels. A good inspection procedure would include appropriate checklists suited to the characteristics of the lining, as is being done by some railroads. The check-list may also contain a few simple tests on samples of the lining in order to judge the required corrective measures. For, the maintenance of tunnels, like the

whole tunneling technology, is still an empirical science (or perhaps an art) based largely on experience and judgment.

The conventionally used corrective measures which include steel (rib) supports, liner plates, and cast-in-place concrete for maintenance and renewal of tunnels are quite effective but generally involve considerable cost. Therefore, the application of such methods is deferred usually until deterioration is considerably advanced or when other less expensive methods, such as grouting or surface repair, fail to alleviate the problem.

The application of shotcrete obviates the difficulties. This method has demonstrated that it offers much greater flexibility than the conventional methods and it can be used for tunnel maintenance under a wide variety of conditions, and is generally more economical.

(5) Acknowledgments

The chairman appreciate s the cooperation offered by members of this committee. On behalf of the committee, the chairman is also very thankful to fellow railroad engineers, material suppliers and many others associated with railroad tunnel work for their cooperation and assistance in the preparation of the report.

Report of Special Committee No. 2

Posting Piling Using Epoxy Resin

J. W. Storer, Chairman
Vice President, Osmose Wood Preserving Co.

History

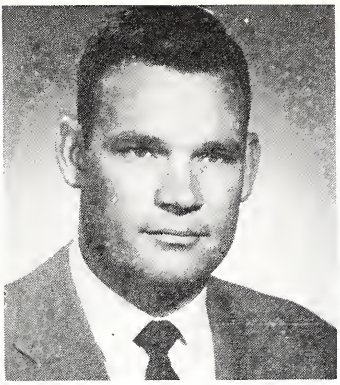
Many members of the American Railway Bridge and Building Association first learned of epoxies during a panel discussion at the 1961 convention titled, "Epoxies and their uses in railroad B&B work." Panel members were: J. R. Williams, engineer of bridges, Rock Island, R. C. Alexander, technical representative, Jones-Dabney Co., and Freeman Drew, assistant research engineer, structures, Association of American Railroads (now bridge engineer, Milwaukee Road).

A highlight of that report was a demonstration of the mixing, curing and strength properties of epoxies by Mr. Alexander. In summary, the report stressed these unique features:

- Remarkable adhesive properties
- Resistance to chemical attack
- Waterproof
- Available in a wide range of viscosities and mentioned certain applications, such as;
- Paints and coatings
- Bonding fresh concrete to old concrete.
- Epoxy sand mortars for patching spalled concrete
- Shear keys in prestressed concrete box girders for railroad bridges.

During the 1962 convention in a special subjects committee report titled, "Application of epoxy type materials

in B&B work," Mr. J. W. DeValle, committee chairman, discussed the field use of epoxies and went inso some detail stressing the importance of correct mixing and application procedures for various uses, and the precautions required for safe handling by the work force. In addition, a listing of successful uses experienced by committee members was given—and, for the first time, it was reported that epoxies had been used successfully in posting bridge piling.



J. W. Storer

Purpose

Since 1962, it has been generally known that some railroads were using epoxy resins for posting piling. One of the purposes of this committee was to sample the industry to find the extent of use, problems encountered, if any, and whether the method was considered to be an improvement over more conventional methods.

Results of questionnaire

Your committee prepared and sent out a questionnaire to the chief engineers of 27 railroads and a summary of the pertinent information follows:

(1) Twenty-four of 27 railroads replied to the committee's questionnaire.

(2) Posting or stubbing is performed by a variety of methods, including scabbing, toe-nailing with spikes, bonding with epoxies, and pouring concrete collars.

(3) Sixteen of the 24 railroads replying have posted piling using epoxy resins. Eight report no experience.

(4) Fourteen of the 16 report satisfactory results.

(5) Of the two reporting unsatisfactory results, one reports mis-use of the materials by B&B forces, and the other reports 100% failure on one bridge with the reason not definitely established.

(6) Of the 16 railroads using epoxies for posting, 16 purchase ready-to-use "packaged" formulations, and one railroad purchases in bulk and mixes on the job site.

(7) Fifteen railroads report that epoxies now available in packaged form are suitable for field use. One did not.

(8) When asked for recommendations on improved packaging or application procedures, the two mentioned most were:

(a) Printing maximum shelf life on tubes.

(b) Training B&B gangs in proper mixing and application procedures.

(9) Of the 14 railroads reporting satisfactory experience with epoxy resin posting, one road has had nine years field experience, and one reports their first installation just a few months ago. The complete tabulation follows:

Year	*No. Railroads*
1961	1
1962	3
1963	4
1964	2
1969	2
1970	1
Unknown	1
	14

(10) Eleven of 16 reporting railroads have had no service failures, four report some cracking in the epoxy joint, and one reports 100% failure of joints on one bridge where scabbing was required.

(11) Thirteen railroads provided

estimates of the number of piles posted using epoxies and this totalled 2,270 piles, with one railroad reporting 750, another 500, and four others reporting 100 or more.

Conclusion

As a result of your committee's questionnaire, it is obvious that posting piling with epoxies is becoming an accepted procedure in the industry. Some of the reasons for this are:

- Superior compression strength
- Adequate flexural strength
- Permits posting of short sections
- Minimizes bracing removal and replacement
- Accurate saw cuts not required
- Superior adhesive qualities
- Sealing of joint prevents entrance of water and future internal decay
- 100% bearing of postal section

Notwithstanding all of the above, there are a number of important factors that must be considered in planning and implementing a posting program using epoxy resins. Some of these are:

(1) Selection of proper epoxy compound—one specifically designed for this use.

(2) Training of forces in proper mixing and application procedures, according to manufacturer's directions.

(3) Use of wedges in the joints to take load during the curing period.

(4) Avoid bonding of freshly creosoted timbers — use sound weathered timber whenever possible.

(5) Do not replace bracing until the epoxy has set up since stress developed by tightening of bolts can cause failure in the joint during the curing period.

Demonstration

To underline the importance of proper application procedures, the committee has arranged a full-scale posting demonstration, and I would like at this time to introduce Mr. Bob McGuire, area manager, Osmose Company, Kansas City, Kans., and Mr. Paul Gunning, chief chemist, Osmose Company, Buffalo, N.Y.

At the conclusion of this demonstration, Mr. Gunning and Mr. McGuire will be glad to answer any questions you might have regarding the technique developed by their company.

Progress in Development and Testing Track Scales for Coupled-In-Motion Weighing

A. L. Hunter, Chairman
Structural Inspector, Bessemer & Lake Erie

When this committee was assigned this subject, it appeared to us that we had two topics. Therefore, we decided to treat it as such.

(1) The development of track scales for coupled-in-motion weighing.

(2) The testing of track scales for coupled-in-motion weighing.

The idea of weighing railroad cars coupled together in a moving train is not new. As early as 1900, railroad scale men realized that if cars could be weighed successfully in this manner, the savings in time and money would be tremendous.

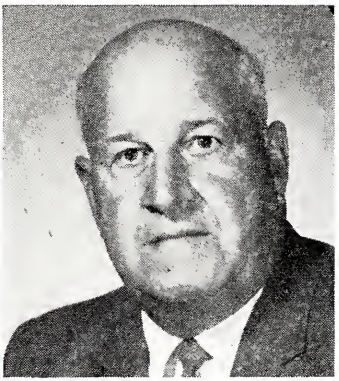
From 1900 until 1914, railroads tried to weigh cars coupled-in-motion by many means.

In 1914, the ICC prohibited by rule in the National Code this method of weighing for interstate transportation.

In the 1920's several railroads, transporting iron ore, entered into agreements with the mines, mills and other shippers, whereby they could weigh ore coupled-in-motion. This was restricted to trains of captive cars of uniform length weighed on a scale tailored to fit this length. This scale length permitted only four axles of one car to be scale borne at the time the mechanical recorder printed the weight. Then the 12-ft 6-in scale, weighing two draft, permitting the weighing at longer wheel base cars, was placed in service on some railroads.

This was the extent of coupled-in-motion weighing for about forty years.

Then about 1950, three things happened that made coupled-in-motion weighing both desirable and practical.



A. L. Hunter

(1) The railroads started to become cost conscious. They began to realize, that if they were to stay competitive in the economy of a fast-moving world, they had to take advantage of every cost-saving device made available to them.

(2) Longer wheel base, multi-axle railroad cars started to come into the picture and had to be weighed. Most roads did not have scales long enough to do this single draft.

(3) The scale manufacturers introduced the electronic load cell into railroad weighing.

For the next ten years scale manufacturers and railroads experimented with electronic track scales to weigh coupled-in-motion. They were successful in developing a scale that would weigh accurately in this manner. They were able to prove this to the satisfaction of the ICC on January 10, 1962.

The National Code of weighing and reweighing of carload freight was modified to provide that cars could be weighed in motion, coupled or uncoupled.

In preparing this report, we tried to find how many railroads and industries were weighing cars coupled-in-motion. We prepared a questionnaire with eight questions about coupled - in - motion weighing. These were sent to the people responsible for scales on 60 railroads. Only 40 of these were returned. But from these 40 questionnaires and information received from four major scale manufacturers, we have come up with some figures. We know that these are not absolutely correct, but we do believe them to be fairly close.

We find that there are approximately 220 coupled-in-motion electronic track scales in use in the United States at the present time. This will be increased by about 30 that will be installed this year. These scales are divided about equally between railroads and railroad-served industries.

Of the 40 railroads that returned the questionnaires, 18 are weighing on their own scales coupled-in-motion, and 33 had industries on their lines that owned and used scales of this type. Seventeen are installing new scales this year, and 32 are making feasibility studies of this mode of weighing.

The weigh rails of these scales vary in length from 4 ft 3 in to 12 ft 6 in. Some are attended, others are unattended. The majority of the present installations, are truck scales weighing two draft, but many axle scales are installed weighing 4, 6, or 8 draft. Some weigh unidirectional, others bi-directional.

Each railroad has to make an evaluation of their weighing requirements to determine the type of scale best suited for their needs.

Location is also very important. With attended scales, you are confined to terminals or at points where agencies are maintained. Unattended scales can be installed at any point, no matter how remote. This enables you to select the most suitable section of track that you have. This is one of the most important decisions you have to make and much of the success of your weighing depends upon it.

The ideal coupled-in-motion scale is one installed on a descending grade from 0.1% to 1.5%, in the middle of a tangent twice the length of the train to be weighed. However, very few installations are made where these conditions exist. Scales and scale tracks have to be tailored to fit the existing terrain.

The scale pit, foundations and approaches are very important parts of the installation. The pit should be large enough to not only provide clearance for the weigh bridge and load cells but room for service as well. It must be dry and should be heated. The scale should have at least 80 ft of solid approach in each direction. The approach rails should be anchored securely to the concrete at the end of the scale to force expansion and contraction to occur at some other point than at the gap between the weigh rails.

Electric supply is also a very vital feature, especially if the scale is to be located in a heavy industrial area. Power surges or voltage fluctuation will shut the system down instantly. A special service complete with transformer should be installed. Even this does not always solve the problem. Some railroads have had to install an auxiliary power supply by storage batteries or a generator.

Coupler tension has always been a questionable problem. Some manufacturers recommend the use of a mechanical device to eliminate this tension. Others believe that if you can locate the scale on the right grade, and the engineers can learn to handle the train in the right manner, coupler tension will not be a serious problem.

Communication between the engineer and the scale during the time of weighing is very important. The engineer must know that he is maintain-

ing a speed satisfactory to the weighing cycle of the scale. This can be accomplished by either lights or radio.

If the scale is to be installed on a mainline track, it should have a dead rail to enable trains not to be weighed to pass over the scale without activating it. Installations of this type should have at least 800 ft of tangent track between the scale and the dead rail switch at each end.

The scale house should be large enough to provide room for the instruments and a work area, but not large enough to be used as a store room. It should be provided with a heater and an air-conditioning unit. The temperature should be maintained at 70 deg., and the air dust-free. Each railroad has to determine for itself what accessories, from those available, would be best suited for their operation. These include various types of electronic readouts, printers and teletypes.

When the AAR selected an ACI system as the one to be universally used, it removed the last roadblock to Automatic Car Identification. This opens a vast new field in railroad weighing through data flow. The possibilities through the use of data flow are almost unlimited.

The latest scale to be developed for coupled-in-motion weighing introduces an entirely new concept to the scale industry. This scale is using a machined beam 45 in long in place of a section of rail the same length. The beam is supported at each end, with strain gauges on its bottom surface. Weight of each passing wheel is measured by the strain gauges, which sense bending stresses in the weigh-rail. This scale is installed on a slab of reinforced concrete. There is no pit, the scale structure is simply bolted to the top of the concrete. The scale has no moving parts or mechanically triggered switches. One total weight for each car is recorded by a standard teletype printer which can be remotely located. This scale is unattended.

All any scale manufacturer can sell you is a workable electronic weighing package. This scale and instrumentation designed to weigh railroad cars, coupled-in-motion, is capable of producing accurate weights if all the other requirements are met. The accuracy of the coupled-in-motion scale is constantly improving. It will improve more as a greater number of railroads use them, when the operating people learn how to better handle the train during weighing, and if and when cars are maintained to a higher standard.

Failures in the electronic scale system can and will occur. However, the frequency of such failures on a car for car basis should not exceed those encountered on mechanical scales.

The experience of some railroads with coupled-in-motion weighing has been very satisfactory. We have heard of railroads that have reduced the cost of weighing a car from $10 to $.50. One major railroad installed two coupled - in - motion scales interfaced with Automatic Car Identification. The total cost to the railroad was nearly $700,000, but this system paid for itself in just nine months. Other roads have realized savings by closing down entire yards. One railroad installed a coupled-in-motion scale at a cost of $550,000. This scale cut the cost of weighing per car from $26 to $.26. They claim savings of $4,500 a day from this scale.

At the start of the present conversion to coupled-in-motion weighing, it was confined to railroads weighing unit trains of coal; and I believe these are the roads that have experienced the best results and the greatest savings.

The experience of some other roads has been very discouraging. Some railroads have coupled-in-motion scales installed on their property that they can't use. They simply won't work and the manufacturers that installed them don't seem to be able to make them work to the satisfaction of the railroad.

It has been pretty well established by several tests conducted by AREA Committee 14 and tests made by in-

dividual railroads on their own scales, that all cars weighed coupled-in-motion will not weigh within the prescribed 0.2%.

Recent tests point out that from any given number of cars, weighed while coupled in a moving train, about 15% can be expected to deviate from their true weight by 500 lb and about 6% of the total cars weighed will show a deviation of 1000 lb or more. Percentage wise, one can expect 86.34% of the cars weighed to fall within plus or minus 0.5% of the true gross weight, with 4.80% of the total number weighed having errors in excess of one percent.

A typical recent test of a coupled-in-motion scale on a western railroad showed: 77% of the cars weighed had errors of 0.2% or less, 89% with errors of 0.3% or less, and no car in the test had an error of more than 0.5% of the true weight. This is better than most of the test results we have seen.

While it is possible that this is close enough tolerance for bulk weighing of commodities such as coal and ore, is it accurate enough for weighing higher-priced commodities?

Canada has established a set of rules under which coupled-in-motion weighing would be approved. The first rule states, "use of coupled-in-motion will be restricted to trains of cars containing bulk material having a value at destination of under two cents per pound shipped from a single shipper to a single consignee."

This is very restrictive and removes many of the benefits we hope to achieve by coupled-in-motion weighing. We must make every effort to avoid having these restrictions placed on this method of weighing.

The best way to accomplish this is by policing all of our own weighing. To do this requires proper maintenance. You can't install these scales, calibrate them, and then forget them. Frequent test and check weighing are a must. It would be advisable to switch five cars out of one train each week and static weigh them. This is the simplest and surest way to keep track of your weighing results.

Many years ago when weighing first began, a man by the name of Job made the statement: "Let me be weighed in an even balance that God may know mine integrity." The integrity of railroad weighing has been of the highest degree for many years. Commodities are sold on the basis of railroad weights. The ratio of weight claims compared to total cars weighed has been very low. This is the way it should be. When a shipper receives a weight from a railroad he should be able to accept this as being accurate. When everyone buys a commodity priced on a railroad weight he should be able to have full confidence that the weight is correct.

We have heard that today cars are being interchanged with errors of 20,000 or 30,000 lb. One car, a 70-ton gondola, was loaded with scrap iron and shipped into Canada where it burned off a journal. After being repaired, this car was weighed while still loaded. It was found to weigh 51,000 lb more than the weight of the shipping bills. It was loaded 38,000 pounds over the load limit of the car. This car was traced back to its point of origin. It was found this car was weighed coupled-in-motion, happily not by a railroad, but by a railroad-served industry.

Errors of this degree are an exception rather than the rule. But it is hard to visualize even one error of this magnitude, occurring on a mechanical static scale.

Today, railroads are weighing coal, ore, coke, cement, limestone, pulpwood, wood chips, lumber and lumber products, chemicals and grain. We are going to have to use a little judgment and maybe some restraint when selecting commodities to be weighed coupled-in-motion. Each railroad is going to have to decide what they can weigh successfully by this method. One caution, do not light-weigh cars coupled-in-motion.

The scale manufacturers are con-

stantly trying to improve their product. The more coupled-in-motion scales that are installed, the more problems will develop, and more means will be found to correct them. With the railroads and scale manufacturers working together, a better, more reliable scale will be developed. And as our technology in use of electronic data improves, so will the accuracy and reliability of coupled-in-motion track scales. In the, not too distant, future we will be able to weigh all cars and all commodities successfully.

Testing Railroad Track Scales For Coupled-in-Motion Weighing

Our testing of railroad track scales for coupled-in-motion weighing must be classified as a most important procedure. Our weighing systems are a proof of responsibility for our individual companies and the entire railroad industry. We must be cognizant of the cash register value of our weighing instruments.

Our customers deserve complete confidence in our integrity and the high degree of accuracy produced from our weighing systems will provide this assurance. Our testing method must be uniform to maintain the present standard of weighing excellence. In addition to providing acceptable results for the customer, and the regulating agencies, scale tests should produce useful information which will aid in improving the design criteria. Uniformity will be the badge of authority for our railroads.

A known mass of weight or scale test car is our testing standard. The railroad scale test car is an absolute weight and the precise calibration programming of the scale test car guarantees accuracy to within one pound.

There are several master scales located throughout the United States which are used only for the calibration of scale test cars and other official testing equipment. Certified scale test cars should be verified for and corrected as often as may be required to insure their accuracy.

The National Bureau of Standards in Washington, D.C., is our regulatory agency. Herein is kept two accurate copies of the fundamental standard from the International Bureau of Weights and Measures located near Paris, France. Our National Bureau of Standards calibrate the master scales periodically with their intricate testing equipment and so their precise programming is our badge of excellence in the testing field.

Our initial, or as found, test ascertains the scale's past performance and accuracy. This primary test will assist us to discover a possible malfunction within the weighing system and can be used as a check list for arbitrary claims. The results of this test are recorded and will be used for reference as our testing program continues.

The next step is a thorough inspection of the entire weighing system. The importance of the checkout procedure cannot be overstressed. We must be sure that the scale is properly installed and all of the specifications have been complied with.

The scale rails and the approach rails must be level with each other. A uniform rail clearance between these rails must be maintained. Perfect rail alignment is necessary. These rail requisites are essential to the proper performance and accuracy of the weighing instrument. The rail acceptance procedure will eliminate excessive transfer shock as the weighers are approaching, moving onto and off of the scale rails.

The steel weighbridge must be checked for possible defects. The check rods must be parallel with the scale rails and anchored securely without causing a bind.

The electronic load cell is the heart of our weighing instrument. Mal-alignment, vertical or horizontal deficiencies will transmit errors into our weighing.

The control panel is a complex system of wiring and electronic elements and is an important part of our inspection.

After we are satisfied that all the

parts of our weighing instrument are operational and in good working condition we can continue with our testing program.

To evaluate the accuracy of the coupled-in-motion scale properly, a static type lever system scale is used for a comparison test. A through inspection of the scale lever system is necessary and a capable weighmaster must be present to eliminate the possibility of human error. Our testing of the conventional scale will then produce the capability and accuracy of the scale alone.

Our final test procedure will require a test train composed of the scale test car and fifteen railroad cars.

The test train will have various types of railroad cars, i.e., empty and loaded box cars, gondolas and hopper cars. This train is to be moved over the scales in a varied order of sequence.

Only the best weighers must be used if we are to produce the best test figures and prove the accuracy and repeatability of the weighing system. Liquid loads must not be used, the possibility of moisture gain or loss must be omitted from our test train. A visual inspection will reveal bad wheels, bad springs, bad journals and bad couplers which must be removed from our test train.

Our test train is now ready for weighing statically to prove our exact car weights on our conventional scale.

We must weigh the cars statically several times to confirm the capabilities of our conventional scale. Once our accuracy is confirmed on the scale lever system scale, we can move our test train to the coupled-in-motion weighing system for our final tests.

This in-motion test must be repeated at least ten times for a good repeatability test performance procedure.

The speed of our train must be constant with an approximate speed of five miles per hour with no acceleration or deceleration.

Our objective is to prove to our companies and our customers that we do have an accurate weighing system, fully reliable and in good working order.

Accuracy is the most important factor, speed is essential and proper maintenance completes the perfect weighing cycle.

The testing of coupled-in-motion track scales is a very controversial subject. It is a rather complicated operation when done with meaningful results. For us to tell you we have an absolute rule or means for this type of test would be wrong. We do know it is very costly. It is not uncommon to tie up a train crew and locomotive for one, two, or even three days to test one coupled-in-motion scale.

First, you must realize we are not testing a scale, as such. When testing a scale that is to weigh moving cars coupled together, we are testing a weighing system.

We have seen the results of a test one of the eastern roads made on a coupled-in-motion scale using a 151-car train. Each of these cars was weighed twice in motion uncoupled on a mechanical scale. Then, coupled together, they made five runs over the coupled-in-motion scale with all 151 cars. The cars were then taken to a third scale and weighed twice again in motion uncoupled. You can imagine what this cost. But when they were finished, they had a pretty good idea how their scale was performing.

There is some difference of opinion as to the use of test cars to calibrate a coupled-in-motion scale. Some people think two test cars, 40,000 and 80,000 lb are sufficient to adjust a scale. Others believe you need three known weights to accurately calibrate a coupled-in-motion scale. It is the opinion of some scalemen that a coupled-in-motion scale should be calibrated at 80% of its capacity.

Most railroads have test cars of two different weights, but we do not know of any that have three. We do not know of any test cars that will weigh 80% of the capacity of a coupled-in-motion scale.

For the present, we are going to have to test with the equipment we have, and by check weighing some of the cars, weighed coupled-in-motion, on another scale. This should keep us informed as to the satisfactory performance and accuracy of the coupled-in-motion scale.

Report of Standing Committee No. 1—Materials

Waterproofing Railroad Bridge Decks

Freeman P. Drew, Chairman
Bridge Engineer, Milwaukee Road

How often has the inspection report read, "Bridge deck leaking"? Bridge engineers didn't plan it that way, that is just how it has worked out only too often. However prevalent deck leaks have been in the past, the prospects are good for improving the situation. With the recent introduction of rolled-out sheets of an elastomeric material, full width and length of the deck, the problem of bridge deck leaks seems to have attained a solution. Laboratory investigations and innumerable field applications have shown that this method of waterproofing a bridge deck is effective.

F. P. Drew

This report will present a discussion of the old standard built-up asphaltic membrane system, the relatively recent elastomeric-sheet membrane system and other systems which have been used or which show promise for success. Laboratory tests will be discussed as well as field applications.

The bituminous membrane system

The type of membrane waterproofing which has been recommended in the AREA Manual for many years is the bituminous membrane system, consisting of two or more plies of bituminous-treated cotton fabric and bituminous-treated felt, placed in prescribed layers and lapped to form four types as follows:

(a) 2-ply system—Two layers of bitumen-treated cotton fabric and three moppings of bitumen.

(b) 3-ply system—Three layers of bitumen-treated cotton fabric and four moppings of bitumen.

(c) 3-ply system—Two layers of bitumen-treated felt, one middle layer of bitumen-treated cotton fabric and four moppings of bitumen.

(d) 5-ply system—Four layers of bitumen-treated felt, one middle layer of bitumen-treated fabric and six moppings of bitumen.

These are shown schematically in Fig. 1.

It can be readily appreciated that, if these multiple-ply systems are laid exactly as prescribed, it requires close attention to the construction procedure. Furthermore, after a strict compliance with instructions, it is discouraging if the deck eventually leaks anyway!

Laboratory research—Evaluation of various membrane type

The purpose of any membane system is to protect the deck of the bridge from the harmful effects of water. The system, therefore, whether it is to be applied to concrete slabs, steel plates or even timber planking, must be impervious and what is probably MOST important, it must be flexible. It is probably this property of flexibility, or rather a lack of it, that has caused more membrane failures than any other. The importance of providing flexibility in the joints, particularly at expansion joints and at other locations when, by the action of the live load, deflections and deformations occur to cause excessive stretching and rupture of the membranes.

A very limited amount of laboratory research has been conducted to demonstrate the performance of various waterproofing membranes. One such investigation was conducted and results were reported in the 1960 AREA proceeding. This research was designed to evaluate the ability of various membranes to bridge cracks which might develop in concrete on which they were applied. Thus, flexibility over a temperature range of 0 deg. F to 70 deg. F was the greatest factor which determined relative performance. The results of this study indicated that:

(1) Three-ply membranes are better than two-ply membranes.

(2) Three-ply cotton fabric membranes are better than three-ply felt-fabric-felt; also better than five-ply felt - felt - fabric - felt - felt membranes.

(3) Three-ply felt-fabric-felt behaves equally as well as five-ply felt-felt-fabric-felt-felt membranes.

At temperatures near zero degrees (F), these membranes were shown to have very little ductility and, under service conditions, this probably contributes to their failure and results in deck leakage.

The butyl rubber membrane system

Since the bituminous membrane system had proved to be a continuing source of problems for the bridge en-

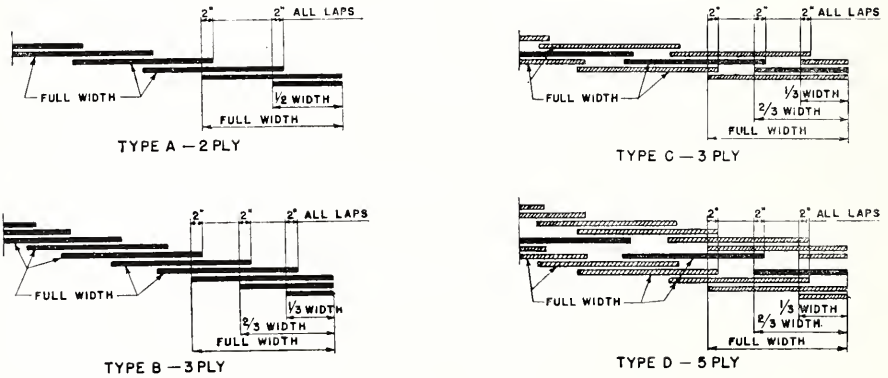


Fig. 1

gineer, there was a fertile area created wherein a new and more effective system was needed.

In 1964, the idea of using butyl rubber sheeting was conceived. The simplicity of unrolling one continuous sheet to cover the entire bridge deck without field splices had immediate appeal. Whereas the bituminous membrane requires many lap splices, each of which is a potential trouble spot, here was a covering that, from the start at least, was completely impervious to water. Butyl, which is a man-made synthetic, also has other advantages.

(1) It remains flexible and elastic over a wide temperature range.
(2) It is impermeable to water.
(3) It resists tearing and abrasion.
(4) It resists aging by sun, weather and temperature.

Since 1964, there have been many railroad bridge decks waterproofed with butyl sheeting. Most of these were installed using a 1/16 in thick sheet and a layer of asphalt planks 1¼ in thick over the sheeting as a protective cover. This thickness of cover was used because this had been one of the recommended methods of protecting the bituminous membrane. It was reasoned that, if a bituminous membrane which was ½ in to ¾ in thick required 1¼ in of protection, surely a 1/16 in thick butyl sheet would require as much protection. As more and more use was made of the butyl, it was found to be a tough material and one that could resist some degree of puncturing. No one, however, was ready to put crushed rock ballast *directly* on the butyl sheet!

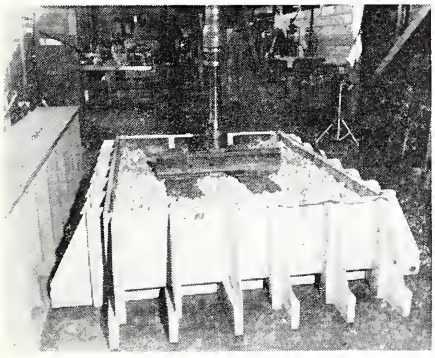


Photo 1

Laboratory research—Membrane protection

How much protection is needed? This question was asked the Research Staff of the Association of American Railroads and as a result a laboratory investigation was begun in 1968 to study various methods of protecting an elastomeric membrane against puncturing by the ballast.

Description of test setup

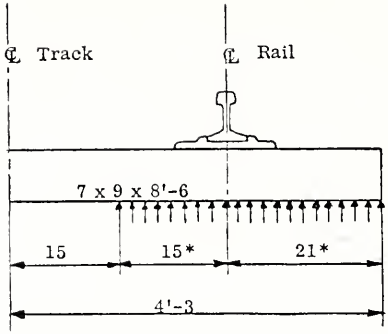
The test setup, shown in Photograph 1, consisted of a simulated bridge ballast trough. It was 5 ft wide ,7 ft long and 15 in deep. It was lined with ¾ in plywood on closely spaced support timbers. The 1/16 in thick membrane sheeting was laid in this trough—over the bottom and up the sides—in one piece. The corners were folded to avoid cutting and resealing. Over this sheeting was placed the protection material to be studied. The same thickness was used on the sides as on the bottom. Six inches of slag ballast was then spread over the floor of the trough and two 3 ft 6 in lengths of oak ties were placed on the ballast, 20 in on centers. The remaining space to the top of ties was filled with the ballast. The trough was then filled with water to a depth of about 3 in.

Loading

The loading selected was that equivalent to 72,000-lb. axles plus 50% impact. Since it can be assumed that one tie will carry about 40% of a wheel load, the resulting pressure on the ballast will be 67 psi as indicated on Fig. 2. This pressure distributed over the two 4 ft 6 in ties, each 9 in wide, resulted in a test load of 50,000 lb. This load

BEARING PRESSURE ON BALLAST

WOOD TIES (8'-6)
(Spaced at 20 in Center to Center)



*AREA Manual, page 5-5-8 recommends that 8'-6 ties be tamped from end of tie to a point 15 in inside of rail.

LOAD ON TIE:

Wheel Load (E72)	=	36,000 lb
Impact at 50%	=	18,000
Total	=	54,000 lb

Field tests indicate that one tie will carry approximately 40% of the wheel load.

Average pressure on ballast =

$$\frac{54{,}000 \times 0.40}{9 \times 66} = 67 \text{ psi}$$

Fig. 2

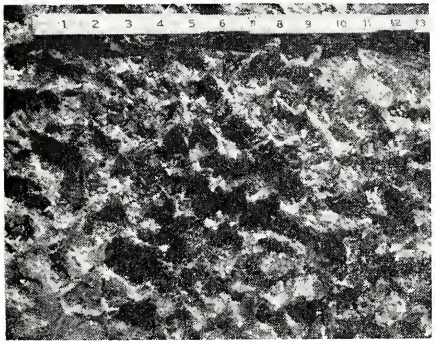


Photo 2

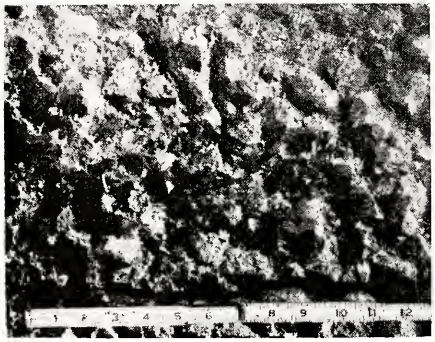


Photo 3

was applied repetitively until failure or 5,000,000 cycle had been applied.

Types of protection studied

Tests were completed on four types of protection:

(1) One layer of ½ in thick proprietary asphalt board.

Photo 4

(2) Two layers of that used in No. 1.
(3) One layer of ½ in thick proprietary asphalt board of a material complying with AREA requirements for the 1¼ in thick planks.
(4) One layer of 1¼ in asphalt planks per AREA Specifications.

Other types of protection were planned such as the use of a 2 in thick sand cushion in combination with one or more of the above.

Results of the Investigation

Test No. 1: After 5,000,000 repititions of load, the ballast was removed from the trough. As shown in Photograph 2, there was severe cavitations directly below the ties. The ballast had not only punctured the protection board, but also the butyl membrane. Upon removing the butyl sheet from the trough, it was found to have several holes in it and the floor of the trough was wet and stained.

Test No. 2: After 5,000,000 cycles of load, it was found that the top layer of protection board was cavitated about the same as Test No. 1. See Photograph 3. The lower layer was only slightly dented. The butyl membrane was not punctured or otherwise damaged.

Test No. 3: The protection material used in this test was harder and more dense than in the previous tests and, after the 5,000,000 cycles, there was some cavitation in the board, but the maximum penetration was ⅜ in. The butyl was undamaged. See Photograph 4.

Test No. 4: The membrane sheet for this test was 1/16 in thick neoprene. The 1¼ in thick asphalt planks were cavitated to about the same extent as for test No. 3 after the 5,000,000 cycles. The membrane was not affected. See Photograph 5.

Conclusion from the tests

These tests indicate that protection boards of the type used here should be at least ½ in thick but need not be more than 1 in thick to adequately protect the membrane sheeting. (The AREA Manual is currently being revised to recommend asphaltic panels in a layer or layers not less than ¾ in thick.)

It was also of interest to note during this investigation that, as shown by photograph 6, the pressure to the protection board was greatest directly below the tie as would be expected but quickly diminished beyond the limits of the area.

It was also apparent from these tests that the thickness of protection board on the sides of the ballast trough could be less than that on the bottom.

AREA recommended membranes

The AREA Specifications recommend the use of two general types of waterproofing membranes for bridge decks:

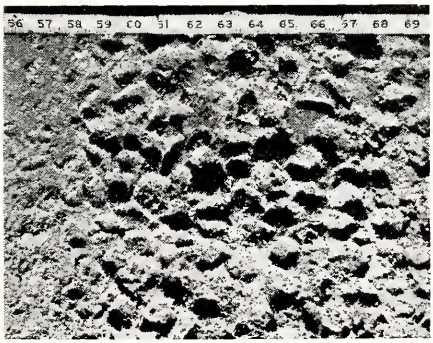


Photo 5

Photo 6

(1) Bituminous membrane.
(2) Butyl rubber membrane.

The materials most often required for the bituminous membrane are:

(1) Asphaltic primer
(2) Mopping asphalt
(3) Asphalt-saturated cotton fabric
(4) Asphalt-saturated felt.

And for the butyl rubber membrane are:

(1) Butyl rubber
(2) Adhesive
(3) Cement
(4) Butyl gum tape.

For bituminous membrane, there is little choice of materials except that the bitumen can be coal-tar pitch rather than asphalt. For the butyl membrane, the choice is mainly in the thickness of the butyl sheet. The specifications recommend three thicknesses; 1/16 in, 3/32 in, or 1/8 in. Some bridge decks have been laid with 1/8 in thick sheets, however, the majority have used the 1/16 in thickness.

For each of these two types of membranes, there are wide varieties of marterials available for use as the protection medium. These may be:

(1) Asphaltic panels, 4 ft. by 8 ft. and ⅜ in thick and thicker; and, asphalt planks, 6 in 8 in or 12 in wide by 3 ft long by 1 in thick and thicker.
(2) Asphalt blocks, 4 in by 8 in and 1¼ in thick.
(3) Brick.
(4) Cast-in-place concrete.
(5) Asphalt or coal-tar pitch mastic. (Not recommended for butyl.)

The materials most often used for protection of either type of membrane are the asphaltic panels and the asphalt plank. Due to the ease of handling, spread of coverage, the asphaltic panels are becoming the most popular. The AREA specifications recommend a total thickness of ¾ in and the panels may be placed in two layers with staggered joints.

Occasionally it may be necessary to place an underlayment material to provide a smooth surface for the membrane. For this the material generally is a bituminous mastic.

Construction procedures for the two types of membranes are quite different. The bituminous membrane requires more materials, more equipment and more control over the steps in the procedure than the butyl membrane. The butyl, on the other hand, can be laid without any special equipment and an adhesive may be the only other material required. The butyl sheet can be ordered to the exact width and length to fit the bridge deck and can be rolled out directly on the deck, using an adhesive only for the vertical or sloping sides of the ballast trough. Splicing and lapping of the butyl sheets can be avoided, however, there is a practical limit to the size and weight of the

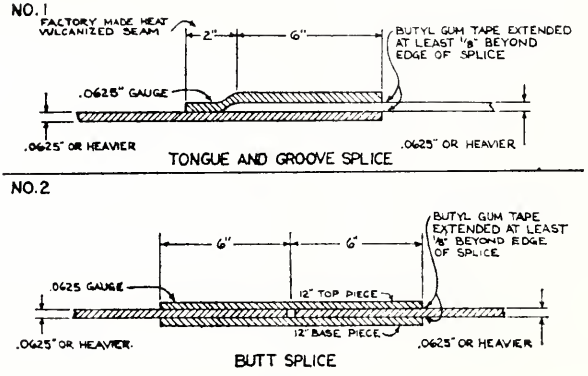


Fig. 3

rolled-up butyl sheet that can be handled conveniently.

The AREA specifications no longer recommend placing the butyl membrane on a mopping of hot bitumen. The use of hot bitumen invariably produces wrinkles in the butyl sheet. This is considered undesirable and could eventually, by the weight of the protection material, ballast and track, crease the butyl such as to produce a rupture. Hence, an adhesive is now recommended for use with the butyl since this is applied cold and wrinkles will not develop. Care should be taken using adhesive to be sure that the solvents have evaporated prior to placing the membrane, or gas pockets and bubbles will form under the membrane.

When necessary to splice or lap the butyl sheet, there are several methods available; all of which are relatively simple and effective. Four types of splices are shown in Fig. 3.

It should be pointed out that, whereas a butyl membrane can be applied at temperature as low at 10 deg F, a bituminous membrane cannot be applied unless the deck surface and air temperatures are at least 50 deg F.

Costs

The cost to apply these membranes will vary in different sections of the country and, of course, will also be affected by the type of deck. If the bridge is skewed, if extensive flashing around drains is required, or if there are other special details, the costs will increase. The following costs, therefore, can only be used as a guide.

Material

Material costs are those which the railroad would pay if brought directly from the supplier through their purchasing department and are approximately as follows:

BITUMINOUS MEMBRANE

Primer	—$0.80 per 100 sq ft
Mopping	
Asphalt	— 0.50 per 100 sq ft
Asphalt felt	— 0.55 per 100 sq ft
Saturated fabric	— 2.25 per 100 sq ft

For a 3-ply membrane, using two plies of felt and one of fabric, the following is obtained:

Primer
—1 @ $0.80 = $0.80 per 100 sq ft
Mopping Asphalt
—4 @ $0.50 = $2.00 per 100 sq ft
Asphalt felt
—2 @ $0.55 = $1.10 per 100 sq ft
Saturated fabric
—1 @ $2.25 = $2.25 per 100 sq ft
Total $6.15

BUTYL RUBBER MEMBRANE

Adhesive	—$ 4.50 per 100 sq ft

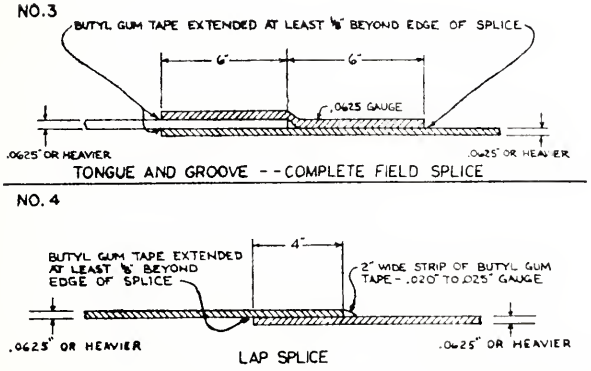

NO.3
BUTYL GUM TAPE EXTENDED AT LEAST ½" BEYOND EDGE OF SPLICE
6"
6"
.0625 GAUGE
.0625" OR HEAVIER
.0625" OR HEAVIER
TONGUE AND GROOVE - - COMPLETE FIELD SPLICE
NO. 4
BUTYL GUM TAPE EXTENDED AT LEAST ½" BEYOND EDGE OF SPLICE
4"
2" WIDE STRIP OF BUTYL GUM TAPE - .020" TO .025" GAUGE
.0625" OR HEAVIER
.0625" OR HEAVIER
LAP SPLICE

Fig. 3 (cont'd)

1/16 in thick butyl – 35.00 per 100 sq ft
3/32 in thick butyl – 45.00 per 100 sq ft
1/8 in thick butyl – 55.00 per 100 sq ft

For a 1/16 in thick membrane and adhesive only on the sides of the ballast trough:

Adhesive	–$ 0.70 per 100 sq ft
Butyl	– 35.00 per 100 sq ft
Total	$35.70

To each of the above membrane material costs must be added the cost of the protection board. Asphaltic panels in ⅜ in and½ in thicknesses are as follows:

⅜ in thick, 4-ft by 8-ft. –$13.06 per 100 sq ft
½ in thick, 4-ft. by 8-ft. –$14.82 per 100 sq ft

Since the current recommendation is for a total thickness of ¾ in, this results in:

Protection board –2 @ 13.06–$25.12 per 100 sq ft

Total material cost, therefore, for the:

Bituminous membrane = $32.27 per 100 sq ft
Butyl membrane = $61.82 per 100 sq ft

Labor

Labor costs vary considerably. If the work is performed by contractor, the costs will probably be higher than if done with railroad B&B labor. On the basis of manhours, however, it is estimated that to apply the:

Bituminous membrane = about 4 MH per 100 sq ft
Butyl membrane = 1½ to 2 MH per 100 sq ft

From the above it is apparent that, whereas the material cost for the butyl system is approximately twice that of the bituminous system the labor to apply the butyl is less than half that of the bituminous system.

Conclusion

The butyl rubber membrane system seems to have certain advantages:

(1) Easy to apply–no special equipment
(2) Lower cost per square foot
(3) Inherent flexibility.

With the past history of bridge deck leakage where, for many years, the bituminous membrane was the only system in use, the bridge engineer can now register some hope that with the butyl system he will receive fewer reports of bridge deck leakage.

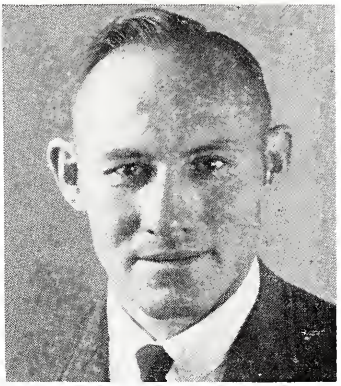
Rail-Highway Equipment

E. A. Albert, Chairman
Superintendent Bridge Erection, Illinois Central

The first responsibility of every supervisor is to see that his company gets the greatest possible return for every dollar that is spent.

In the railroad bridge and building business this means getting the most production possible for every man hour spent on a job.

Proper equipment is one of the basic requirements of getting maximum production once a project reaches the actual construction stage. This report will deal with equipment that is mounted on vehicles that have attachments for travel either on the highway or on the rails.



E. A. Albert

The first record we have found of rail-highway equipment was about 1928. This was used on a bus that traveled both on the highway and on the street railway in Boston. This original effort had limited success. There is very little record of any further use of on and off-track equipment until shortly before World War II, when the military put the rail-highway attachments to use. After the war, popularity again faded.

The dolly-wheel attachment had little use in the railroad industry until about the mid-1950's, but since that time its use has been increasing rapidly. Today, about the only limitations on the equipment than can utilize on-off track attachments are the laws governing overall dimensions, weight and speed of highway vehicles.

Most of the original designs are dolly-wheel attachments on construction equipment were developed by the railroads in their own back shops. These were usually rather simple devices using levers to raise or lower the flanged wheels and a pin to hold them in position. Today we have some quite exotic hydraulic systems that not only are powered up and down but are self-compensating to adjust to track conditions. These systems are patterned after aircraft landing gears. This not only facilitates getting on and off of the rails, but greatly enhances on-track safety as well.

The vehicle with attachments for operating on or off the rails has the distinct advantage of getting to the work site in the proper position to perform the functions it was designed to do, whether it is on the track or on the ground. Many times it is necessary to use a machine, such as a 40 or 50-ton locomotive crane, to perform light to medium tasks in bridge construction and repair, because the truck crane or crawler crane cannot get to the job site. With the flanged-wheel conversion units the truck crane can be assigned to the job and the heavy equipment can be sent to other jobs to do the heavy work, such as driving piling or placing heavier spans. During operations such as pile driving, the truck cranes can "feed" the material to the larger on-

track equipment so that maximum production can be obtained.

By complementing the locomotive crane with the smaller machines, the number of heavier, much more expensive locomotive cranes required on a territory can be reduced.

The on-off track equipment will generally have more on-track working time than equipment restricted to the rails, because it can clear train movements by getting off the rails at the closest suitable road crossing. The machines can be put back on the rails and returned to the work site with a minimum of lost time after a train passes. Railing and unrailing, with most of the newer equipment, is all accomplished by the machine operator, without assistance. When a job is completed the vehicle can travel by the most direct route, either by rail or by highway, to the next work location.

The rail-highway attachments are being used on a variety of equipment today, such as automobiles, station wagons, and pickup trucks for inspection, light hauling and transportation. Heavier trucks, with a wide range of hydraulic cranes or winches and crew cabs are in use. Trucks with articlated booms and baskets for inspection, sandblasting, painting, etc., are common. There are trucks with earth augers, concrete mixers, dump bodies, and chemical spraying equipment. Air compressors, utility trailers, and even trailer houses, have been equipped with flanged wheel attachments.

On-and-off track vehicles are now being used for clearance measuring cars and rail detector cars. Attachments are available for semi-trailers and tractors.

Busses are again being looked at for on and off track transportation in some of the larger cities.

The weights of assemblies run from 175 lb to as much as 10,000 lbs. Prices start about $2,000 and go as high as $15,000.

Considerable improvement has been made to correct some of the drawbacks that earlier conversion units had. The use of aircraft aluminum has reduced the weight, new designs have reduced overhang, but it still presents problems when operating off track. The railing and unrailing operations have definitely improved, and the derailing problem has lessened with the more sophisticated equipment.

It was said earlier that these machines could get in the clear at the nearest grade crossing but that crossing must be a wide one in order to have room to maneuver the vehicle into position for railing or unrailing and moving clear of the track. When a machine will be at one location for an extended period of time, a suitable run-off can usually be prepared to simplify the operation of getting on or off of the rails. Length of the run-off required, of course, depends on the type of vehicle being used, but many crossings are just too narrow to use without prior preparation.

The protection of equipment, when used on track, to see that it is not struck by a train is of vital importance. Operating requirements vary widely on different roads. When working at a fixed location, protection by train order or by detour movement of trains in multiple track territory can be used. When vehicles are being used for inspection purposes or are traveling from one work location to another, some roads use train orders, some use a line-up order, others have track and time limits that are handled with an operator or dispatcher for a specified length of time. It is the responsibility of the person in charge of the vehicle to be in the clear at the specified time.

Radio communication is an additional aid to safety, as well as helping to get the maximum productive on-track time and reducing train delays to the minimum.

Use of equipment that is outfitted with attachments so that they can be used both on and off is one way that we can come nearer to our goal of getting the maximum production from both men and equipment.

Restoration of Tye River Bridge

By Joel W. DeValle
Chief Engineer—Bridges, Southern

Before daybreak on the morning of August 20, the normally peaceful Tye River, draining a segment of the eastern slope of the Virginia Blue Ridge Mountains, became a raging torrent. Swollen by unprecedented rainfall from the last efforts of hurricane Camille, a wall of water devastated the tributary area upstream from its mouth on the James River. Other streams in the immediate vicinity were also pushed beyond flood capacity, washing out homes, roads, bridges and disrupting all normal communications in the area.

Southern's main line south from Washington traversed the heart of the devastated area, and was severed in more than a dozen places by the floodwaters. The most southerly point of damage was at Tye River where the double main tracks were carried across the valley by a steel viaduct. At this location, the torrential flood tore away 480 feet of the steel bridge, leaving 150 feet of the structure still in place on the south end.

Southern's bridge at Tye River was constructed in 1915, and was typical of viaduct design of that era, consisting of alternate 60 and 30 foot spans, supported by steel columns on individual concrete pedestals, except at the most northerly and southerly piers.

Bridge Is Downstream

Upon arrival at the scene late in the afternoon of the 20th, the river was observed to be still in flood condition, above the supporting pedestals. Approximately 1,000 ft. downstream, barely visible in the river, was one mass of twisted steel columns and girders, while another similar jumble of wreckage appeared in the riverbed about one-quarter of a mile further. Individual

J. W. DeValle

girder spans could be seen in the river at various points, but their condition could not be determined because of the height of the water. It was apparent that, of the total of 20 missing girder spans, only a few would be found in serviceable or repairable condition.

The next morning, a meeting was held at the site with Southern's Operating Vice President W. H. Moore, and Chief Engineer R. A. Kelso, who were completing an over-all inspection of the damage by helicopter, since highways in the area were closed. From high water marks in the area, and reports of local residents, it was evident that the viaduct was lost because of the intense pressure of the floodwaters against collected debris of trees, houses and barns which had jammed against the tower legs and pedestals. Although the floodwaters had not yet completely subsided, it was evident that a number of the foundation pedestals were turned over or displaced so that their reuse was out of the question.

Plans for reconstruction were discussed at the site. Surplus deck-plate girders were available from locations in CTC territory, and a tentative selection of three of these spans, each 100 feet long, was made. It was planned to erect these spans in the river channel area, to minimize future exposure of the supports to floodwaters, and to salvage three of the original 60-foot spans from the river for use in the remaining portions of the structure. Since only one track was to be restored, only six spans would have to be erected. The pier footing adjacent to the north abutment was still in usable condition, and the supporting bent for the most southerly span was still structurally sound, so that only four footings and five towers were needed with the girder spans tentatively selected. Contact was made with contractors to determine availability of equipment and construction forces, and studies were begun to develop access routes to the site.

Design of the footings and steel towers was begun on Friday, August 22, and sufficiently completed by Sunday night to permit contacting steel suppliers for furnishing and fabricating the tower legs and caps. Each tower was to consist of only four legs, arranged in conventional bent fashion to minimize interference with stream flow, founded on concrete footings with stems projecting above ordinary high water. Unfortunately, a canvass of all available fabricators and suppliers failed to develop a source able to produce the needed columns within an acceptable time limit, and consequently it was necessary to discard our more conventional design and seek alternate solutions.

Use H-Piles In Emergency

Since the river was shallow and rock was exposed in the channel, and because Southern maintains a supply of steel H-piling for emergency use in construction of trestles and bridges damaged by fires, washouts, etc., an alternate tower design was prepared based on the use of conventional H-piling placed on the bare rock and arranged in a pattern susceptible to bracing and capping with heavy steel caps. Stability of the towers was achieved by encasing the lower ends in concrete.

Several important advantages were gained by this scheme: (1) Piling was immediately available, permitting work to begin, (2) the unit cost of materials in the towers was sharply reduced, since no fabrication was required, (3) individual members were considerably lighter and easier to handle, and (4) it was not necessary to depend on curing and hardening of the concrete before resuming rail operations.

The firm of Oman Construction Company of Nashville, Tennessee was selected as general contractors for the repair work, with A. J. Metler of Knoxville, Tenn., as subcontractors for the steel erection. Southern's own bridge gangs were used for track and deck installation, and handling of materials. Although Oman had a considerable array of equipment in the area assigned to other work, it was necessary to move additional cranes, welding machines, gas cutting outfits, grading equipment and trailers to the jobsite. This was started on Monday, August 25, continuing through the entire week.

Local site topography dictated that all construction work had to be accomplished from the north end of the viaduct. The flood plain at this location offered sufficient space for men, materials, and equipment while the steep rock embankment at the south end prohibited use of that area. Accordingly, the surplus girder spans which were being moved to the site from the south presented a difficult problem to the erectors in moving them to the north bank of the river, since there were no available roads or bridges with sufficient capacities to carry the spans, each of which weighed a net total of 78 tons.

An exhaustive study was begun of local farm-to-market roads, stream fords, etc., for movement of these spans. The heavy deposition of silt, mud, and debris from the flood made movement of equipment over the worksite impossible and it was necessary to stabilize the entire area with stone and crushed stone trucked from nearby quarries before the heavy truck cranes could move in.

Steel piling was laid out flat in the relative positions for application of steel channel bracing and consolidation into the first tower bent to be erected on top of the single remaining northernmost pier footing. A double 4-pile bent almost 55 feet tall was assembled in two separate sections on the ground, then lifted into final position.

Make An Adjustable Template

Meanwhile, a templet was being fabricated for support and alignment of the individual H-piling in subsequent towers. The templet was fabricated from surplus H-piling, with four legs battered to conform to the alignment of the tower piles, and with horizontal platform supports at the top and at mid-height. Adjustable leg lengths were devised to compensate for the irregular nature of the rock in the river bottom, and the templet was marked with reference transverse and longitudinal centerlines. A 100-ton truck crane with four slings was then used to suspend and position the templet under simultaneous guidance from surveyors' transits while the adjustable legs were set in final position on the river bottom and welded in place. Having thus established horizontal control for each tower, the individual piling, which had been field welded into 80-foot minimum lengths, were set in place and tackwelded to the templet to control their positions.

After four rows of piling, each consisting of four 12-inch H-piles, had been assembled for each of the remaining four towers, forms were supported from the templets and the piling, and concrete was pumped from transit-mix trucks through tremie discharge into the forms without dewatering. Size of each base was 16 feet in width parallel to track, 42 feet in length transverse to track, and approximately 11 feet in depth. Because of the irregular bottom surface, each form held approximately 300 cubic yards of concrete, and thus provides about 600 tons of stabilizing weight for each tower.

Sway bracing, consisting of steel channel sections were field-welded to each face of each row of piling, while horizontal separators consisting of short pieces of cut-off piling were welded between individual piles parallel to track to insure stability, minimize any tendency to sway, and to increase the individual stiffness of each member. Pile cut-off elevations were set by survey methods, and 14-inch wide-flange beams weighing 158 lb. per foot were welded in place on each row of piling to serve as a transverse cap. Longitudinal members of the same section were placed across the top of each tower, parallel to the girders to provide bearings which are also effective in securing the tops of each tower.

Handling Girder Spans

Studies of access routes for transporting the 100-foot girder spans from an unloading location just south of the viaduct revealed that substantial obstacles would be encountered. In order to handle the spans over the narrow winding roads, it would be necessary to separate the girders, load them individually on rubber-tired steerable dollies and move them over county roads, cutting trees and relocating interfering power lines, until Tye River was reached, then towing each girder upstream, to avoid soft ground on the banks, to a final resting place before erection.

Before starting disassembly of the

girders, a hurried assessment of the status of track restoration in the devastated area to the north led to the conclusion that the girders could be handled by rail over a circuitous detour some 350 miles in length to the north side of the river before they would be needed. Clearances were obtained from connecting carriers and transportation of these spans over the detour route was accomplished by rail without incident.

Upon arrival of the 100-foot girder spans at the north end of the bridge, two of them were unloaded from the rail cars, positioned on the highway dollies, moved to a spot immediately under their final resting place, and raised into place with a 100-ton truck crane and a 130-ton truck crane. The last 100-foot span was separated into the two girders to reduce the gross weight because of increased height of lift and reach. It was also necessary to separate the last 60-foot span for the same reasons, before erection could be completed.

When the last girder segments had been set and reconnected, the deck was placed in preassembled panels and the rails were installed and bonded.

Due to excellent cooperation by the contractors, favorable construction weather, and availability of materials, it was possible to resume rail traffic at 4:26 A.M. on September 8, only 10 days after work had begun. The completed structure stands approximately 95 feet high from streambed to the base of rail.

Hazardous Chemical Spills in Transit

By E. R. Schlaf
Superintendent of Fire Prevention, Illinois Central

E. R. Schlaf

Ladies, gentlemen, honored guests:

When I was invited to appear on this program to discuss railroad accidents involving dangerous commodities, I did not hesitate to accept because I have a strong belief that maintenance-of way officers need to know more about the behavior of some of the chemicals we haul when involved in derailments and fires. Since track forces, signal men, communications men, and bridge men are summoned immediately, they should know what the product is, whether it is flammable, and/or toxic, whether it is lighter or heavier than air, whether its presence in toxic or explosive concentrations is detectable by odor alone, whether it is corrosive and whether it is reactive.

This sounds like a big order, and it is. Let's take an example: You are called to a derailment involving LP-gas. There is no fire. You carefully approach the scene, sniffing cautiously for LP-gas vapors. What you don't know is that this particular shipment of LP-gas is unstenched! Propane and butane gas are odorless until an odorant is added. When butane is to be used as a propellant in an aerosol can, the odorant is purposely omitted. LP-gas is about 50 per cent heavier than air, so if it is leaking from a tank car without fire it will form a heavy, sometimes invisible (depending upon atmospheric conditions) blanket of combustible gas along low areas on the ground. A lineman working overhead can drop a hot wire to the ground, igniting the invisible blanket, and anyone working in it is going to get hurt. Discarding a cigarette, lighting up an acetylene torch, or many other ignition sources, can give the some results.

Get A Gas Indicator

What's the answer to this particular problem? A combustible gas indicator should be brought into the area and operated by a qualified person. They cost about $125.00, but will save that, many times over, if you can prevent a fire and a personal injury.

On the other hand, I have seen sectionmen shy away from using an acetylene torch when they detected the odor of ammonia. The least detectable odor of ammonia in air is 50 parts per million, or a concentration of 1/200 per cent. A fatal exposure is 100 times that for 30 seconds. The leanest concentration that will burn is 16 per cent or 32 times the fatal concentration. Therefore, if you can voluntarily remain in an ammonia-laden atmosphere, the concentration will be too low to ignite. You simply cannot *voluntarily* remain in an atmosphere that will be permanently harmful to you. This information may seem of little comfort to you, until you realize that fatal concentrations of other commodities, such as hydrogen cyanide, can be inhaled with little or no warning. In fact, hydrogen cyanide can be absorbed through the skin in concentrations as low as 100 parts per million, even if a gas mask or self-contained breathing apparatus is worn.

Can Produce A Bad Burn

I told you that LP-gas is heavier than air and tends to remain in low areas. The specific gravity of Anhydrous ammonia is 0.6, indicating that it is only 60 per cent the weight of air and therefore should rise rapidly. However, it has such a high affinity for water that it will seek it out and combine with it to form aqua ammonia which is heavier than air! Anhydrous ammonia can give you a bad chemical burn because it is caustic. It can also give you frostbite if spilled on the skin.

Both propane and anhydrous ammonia are gases, which for transportation purposes, are cooled and compressed and shipped as liquids. At 100° F, they have pressures of about 200 psi. Ammonia has no pressure at -28° F. Propane has no pressure at about -44° F. Needless to say, fires under such tanks are to be avoided. The relief valve will open at about 250 psi, and, if it is in a position other than upright, liquefied gases will be discharged into the fire, impinging upon its own container or a neighboring container, sometimes with disastrous results, as you will see from the slides and motion picture clips that will be shown later.

Rain Can Be A Problem

From what I have just told you, it can readily be seen that no one could be expected to remember the characteristics of all placarded hazardous materials we haul. And remember that commodities which are not placarded can give you some interesting problems also. An example is calcium carbide. Suppose a car of this ruptured at a de-

railment and the product was wetted either by surface water, or, worse yet, rain. In either case, acetylene gas is formed, but if only a small quantity of water is added to a large amount of carbide, the heat of reaction is often high enough to ignite the gas! If rain enters a hopper car containing calcium carbide, acetylene gas may combine with air present to fall within the explosive range. The heat of reaction could ignite the mixture, resulting in an explosion thereby opening the car further.

What is meant by the term "explosive range?" Take the gasoline in your automobile carburetor. If the automatic choke malfunctions, the gas-air combustion may be too rich to burn, or too lean to burn. The range between the leanest mix and richest mix that will burn is called the explosive range. Each flammable liquid or gas has its own explosive range.

An "empty" propane car may be ruptured at a derailment, and at the moment of rupture the contents are too rich to burn, being 100 per cent propane vapors. However, upon standing, propane may leave and air may enter, diluting the concentration to a point within its explosive range which is 2 per cent to 10 per cent. A spark entering or flying by the rupture could then result in a disastrous explosion.

As I mentioned before, some commodities which are not placarded can still give you problems at derailments. Flammable liquids with a flash point about 80° F are not so marked. What is meant by the term "flash point?" It is the temperature at which a flammable liquid begins to give off ignitible vapors. Thus, a flammable liquid having a flash point of 81° F. is not placarded, yet, if spilled on a hot day, could generate explosive vapors. Of course, gasoline, having a flash point 40 or 50 degrees below zero, is always emitting flammable vapors! Common lube oil, when heated up to 300-500 degrees, can also give off flammable vapors. Cottonseed oil and corn oil have flash points near 500° F. Creosote oil has a flash point of approximately 165° F, so on a hot day watch for acetylene sparks near ties, bridge timbers, and timber poles.

Pamphlets Are Available

From what I have told you, it is obvious that you need to obtain accurate information quickly. Fortunately there are a lot of reliable sources. The Bureau of Explosives publishes their pamphlet 22, which covers recommended procedures for handling collisions and derailments. It costs about 40 cents. They just released, this year, their new pamphlet 7a, entitled "Dangerous Articles Emergency Guide," selling for $2.00 per copy. The National Safety Council's slide rule costs $1.00. The Railway Systems Management Association has a slide rule covering more chemicals, and costing a little more money. The Manufacturing Chemists Association Chem-Card Manual is excellent for the 81 chemicals listed. The National Fire Protection Association publishes the most comprehensive of all in its "Fire Protection Guide On Hazardous Materials." The cost is $5.50.

In addition to these, The national LP-Gas Association has published a poster entitled "How To Control LP-Gas Leaks and Fires," and the Ammonia Industry publishes "NH_3 Agricultural Emergency Guide," which sells for about 15 cents.

Our president, Alan S. Boyd, formerly head of the DOT, has arranged for the distribution of packets covering emergency procedures to every fire department serving the Illinois Central. I believe other railroads, the Southern for one, have similar programs. In addition to the packets, we offer each department free use of some 30 fire-training films, which we also use for instruction at fire schools at local, county and state levels. I wish it were possible to offer these to each of you, but the demand for our films is

too great. However, if you would like to preview some of them, with a view of possible purchase, this might be arranged for on an open date basis. A supply of our film list is on a table at the rear of the room.

The slides and motion picture film clips you are about to see were photographed on our railroad and other railroads. We will confine our comments to the *effects* rather than the *causes* of these derailments. The purpose here is not to embarrass or criticize anyone but to show the problems that can arise at a derailment and possibly some of the solutions to those problems.

And now—the slides.

(Slides were shown)

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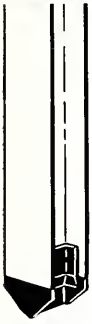

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HISTORICAL INFORMATION

List of Annual Conventions

No.	Place of Meeting	Date	Membership
1	St. Louis, Mo.	Oct. 17-19, 1905	313
2	Cincinnati, Ohio	Sept. 25, 1891	60
3	Philadelphia, Pa.	Oct. 18-19, 1892	112
4	Kansas City, Mo.	Oct. 17-19, 1893	128
5	New Orleans, La.	Oct. 16-18, 1894	115
6	Chicago, Ill.	Oct. 15-16, 1895	122
7	Denver, Colo.	Oct. 20-22, 1896	140
8	Richmond, Va.	Oct. 19-21, 1897	127
9	Detroit, Mich.	Oct. 18-19, 1898	148
10	St. Louis, Mo.	Oct. 17-19, 1899	148
11	Atlanta, Ga.	Oct. 16-18, 1900	143
12	Minneapolis, Minn.	Oct. 15-17, 1901	171
13	Quebec, Canada	Oct. 21-23, 1902	195
14	Chicago, Ill.	Oct. 20-22, 1903	223
15	Pittsburgh, Pa.	Oct. 18-20, 1904	293
16	Boston, Mass	Oct. 16-18, 1906	340
17	Milwaukee, Wis.	Oct. 15-17, 1907	341
18	Washington, D. C.	Oct. 20-22, 1908	368
19	Jacksonville, Fla.	Oct. 19-21, 1909	393
20	Denver, Colo.	Oct. 18-20, 1910	428
21	St. Louis, Mo.	Oct. 17-19, 1911	499
22	Baltimore, Md.	Oct. 15-17, 1912	524
23	Montreal, Quebec	Oct. 21-23, 1913	570
24	Los Angeles, Cal.	Oct. 20-22, 1914	586
25	Detroit, Mich.	Oct. 19-21, 1915	665
26	New Orleans. La.	Oct. 17-19, 1916	710
27	Chicago, Ill.	Oct. 16-18, 1917	704
28	Chicago, Ill.	Oct. 15-17, 1918	716
29	Cleveland, Ohio	Oct. 21-23, 1919	776
30	Atlanta, Ga.	Oct. 26-28, 1920	840
31	New York, N. Y.	Oct. 18-20, 1921	850
32	Cincinnati, Ohio	Oct. 17-19, 1922	865
33	Seattle, Wash.	Oct. 16-18, 1923	846
34	Kansas City, Mo.	Oct. 21-23, 1924	837
35	Buffalo, N. Y.	Oct. 20-22, 1925	759
36	Richmond, Va.	Oct. 12-14, 1926	750
37	Minneapolis, Minn.	Oct. 18-20, 1927	754
38	Boston, Mass.	Oct. 23-25, 1928	755
39	New Orleans, La.	Oct. 15-17, 1929	755
40	Louisville, Ky.	Oct. 21-23, 1930	713
41	Chicago, Ill.	Oct. 16-18, 1934	592
42	Chicago, Ill.	Oct. 15-17, 1935	547
43	Chicago, Ill.	Oct. 20-22, 1936	588
44	Chicago, Ill.	Oct. 19-21, 1937	566
45	Chicago, Ill.	Oct. 18-20, 1938	589
46	Chicago, Ill.	Oct. 17-19, 1939	546
47	Chicago, Ill.	Oct. 15-17, 1940	610
48	Chicago, Ill.	Oct. 14-16, 1941	594
49	Chicago, Ill.	Oct. 20-22, 1942	618

No.	Place of Meeting	Date	Membership
50	Chicago, Ill.	Oct. 20-21, 1943	597
51	Chicago, Ill.	Sept. 17-19, 1946	698
52	Chicago, Ill.	Sept. 16-18, 1947	651
53	Chicago, Ill.	Sept. 20-22, 1948	652
54	Chicago, Ill.	Sept. 12-14, 1949	676
55	Chicago, Ill.	Sept. 18-20, 1950	713
56	Chicago, Ill.	Sept. 17-19, 1951	676
57	Chicago, Ill.	Sept. 15-17, 1952	667
58	Chicago, Ill.	Sept. 15-17, 1953	666
59	Chicago, Ill.	Sept. 13-15, 1954	682
60	Chicago, Ill.	Sept. 19-21, 1951	625
61	Chicago, Ill.	Sept. 18-20, 1956	657
62	Chicago, Ill.	Sept. 23-25, 1957	769
63	Chicago, Ill.	Sept. 15-17, 1958	828
64	Chicago, Ill.	Sept. 15-17, 1959	863
65	Chicago, Ill.	Sept. 19-21, 1960	932
66	Chicago, Ill.	Sept. 18-20, 1961	968
67	Chicago, Ill.	Sept. 10-12, 1962	942
68	Chicago, Ill.	Oct. 14-16, 1963	887
69	Chicago, Ill.	Sept. 14-16, 1964	860
70	Chicago, Ill.	Sept. 13-15, 1965	829
71	Chicago, Ill.	Sept. 26-28, 1966	800
72	Chicago, Ill.	Oct. 11-13, 1967	799
73	Chicago, Ill.	Sept. 9-11, 1968	825
74	Chicago, Ill.	Sept. 9-11, 1969	746
75	Chicago, Ill.	Sept. 28-30, 1970	709

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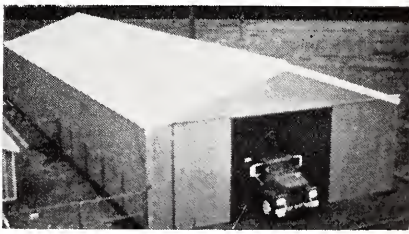

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USS American Bridge builds

World's Longest Vertical Lift Span

The 71-year-old swing span carrying the Staten Island Rapid Transit Railway over the Arthur Kill between Staten Island, N. Y. and Elizabeth, N. J., has been replaced by a modern lift bridge. And there's an interesting story behind the event. When the 496'6" swing bridge was built in 1888, it was the longest in existence, a record it held for many years. It too, was fabricated and erected by American Bridge.

The imposing new bridge, with its 557'11½" thru truss vertical lift span, is also a record-breaker.

But great length is not the only feature about the new bridge. It is an imposing structure from every angle. Big, but not as heavy as it looks because most of the 1,658 tons of steel in it are USS MAN-TEN; the towers are 33' x 32' in width and 163'4" high; and even the vertical lift span itself is huge, being 43'4" deep at the end and increasing to 70' in the center. The old bridge, incidentally, will also be dismantled by American Bridge.

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	J. S. Hancock	A. B. Chapman	A. B. Chapman	B. R. Meyers
	L. C. Winkelhaus	L. E. Peyser	L. E. Peyser	L. E. Peyser

† To November 1, 1962 ‡ To February 1, 1943

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2nd V.-Pres.	E. H. Barnhart	W. F. Martens	W. A. Huckstep	Guy E. Martin
3rd V.-Pres.	W. F. Martens	W. A. Huckstep	Guy E. Martin	F. R. Spofford
4th V.-Pres.	W. A. Huckstep	G. E. Martin	F. R. Spofford	Lee Mayfield
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Treasurer	C. R. Knowles	C. R. Knowles	L. C. Winkelhaus	L. C. Winkelhaus
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	L. E. Peyser	F. R. Spofford	W. D. Gibson	G. W. Benson
	H. M. Harlow	Lee Mayfield	H. M. Harlow	F. M. Misch
	H. B. Christianson	Franz M. Misch	V. E. Engman	L. R. Morgan
	F. R. Spofford	W. D. Gibson	G. W. Benson	J. A. Jorlett

	1950-1951	1951-1952	1952-1953	1953-1954
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1st V.-Pres.	Guy E. Martin	F. R. Spofford	Lee Mayfield	H. M. Harlow
2nd V.-Pres.	F. R. Spofford	Lee Mayfield	H. M. Harlow	J. A. Jorlett
3rd V.-Pres.	Lee Mayfield	H. M. Harlow	J. A. Jorlett	R. R. Gunderson
4th V.-Pres.	H. M. Harlow	J. A. Jorlett	R. R. Gunderson	W. H. Huffman
Secretary	Elise LaChance	Elise LaChance	Elise LaChance	Elise LaChance
Treasurer	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus
Directors	F. M. Misch	M. H. Dick	W. H. Huffman	M. H. Dick
	L. R. Morgan	R. R. Gunderson	L. R. Morgan	J. F. Warrenfelis
	J. A. Jorlett	J. F. Warrenfelis	B. M. Stephens	G. Switzer
	M. H. Dick	W. H. Huffman	M. H. Dick	B. M. Stephens
	R. R. Gunderson	L. R. Morgan	J. F. Warrenfelis	W. H. Bunge
	J. F. Warrenfelis	B. M. Stephens	G. Switzer	E. R. Schlaf

	1954-1955	1955-1956	1956-1957	1957-1958
President	H. M. Harlow	J. A. Jorlett	R. R. Gunderson	W. H. Huffman
1st V.-Pres.	J. A. Jorlett	R. R. Gunderson	W. H. Huffman	M. H. Dick
2nd V.-Pres.	R. R. Gunderson	W. H. Huffman	M. H. Dick	B. M. Stephens
3rd V.-Pres.	W. H. Huffman	M. H. Dick	B. M. Stephens	H. D. Curie
4th V.-Pres.	M. H. Dick	B. M. Stephens	H. D. Curie	
Secretary	Elise LaChance	Elise LaChance	Elise LaChance	Elise LaChance
Treasurer	L. C. Winkelhause	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus
Directors	B. M. Stephens	J. F. Warrenfells	W. H. Bunge	G. W. Benson
	W. H. Bunge	H. D. Curie	E. R. Schlaf	J. M. Lowry
	E. R. Schlaf	J. M. Lowry	G. W. Benson	H. H. Matthews
	J. F. Warrenfells	W. H. Bunge	J. M. Lowry	T. M. von Sprecken
	H. D. Curie	E. R. Schlaf	T. M. von Sprecken	W. H. Bunge
	J. M Lowry	G. W. Benson	H. A. Matthews	E. R. Schlaf

	1958-1959	1959-1960	1960-1961	1961-1962
President	M. H. Dick	B. M. Stephens	H. D. Curie	G. W. Benson
1st V.-Pres.	B. M. Stephens	H. D. Curie	G. W. Benson	J. M. Lowry
2nd V.-Pres.	H. D. Curie	G. W. Benson	J. M. Lowry	E. R. Schlaf
3rd V.-Pres.	G. W. Benson	J. M. Lowry	E. R. Schlaf	H. A. Matthews
Secretary	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg
Treasurer	L. C. Winkelhaus	L. C. Winkelhause	L. C. Winkelhaus	L. C. Winkelhause
Directors	J. M. Lowry	W. H. Bunge	H. A. Matthews	R. C. Baker
	R. C. Baker	E. R. Schlaf	M. J. Hubbard	R. H. Miller
	W. H. Bunge	H. A. Matthews	R. C. Baker	Shirley White
	E. R. Schlaf	M. J. Hubbard	R. H. Miller	H. M. Wilson
	H. A. Matthews	R. C. Baker	Shirley White	R. D. Hellweg
	M. J. Hubbard	R. H. Miller	H. M. Wilson	F. W. Hutcheson

	1962-1963	1963-1964	1964-1965	1965-1966
President	J. M. Lowry	E. R. Schlaf	R. C. Baker	H. M. Wilson
1st V.-Pres.	E. R. Schlaf	R. C. Baker	H. M. Wilson	R. D. Hellweg
2nd V.-Pres.	H. A. Matthews	Shirley White	R. D. Hellweg	J. W. DeValle
3rd V.-Pres.	R. C. Baker	H. M. Wilson	J. W. DeValle	W. F. Armstrong
Secretary	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg
Treasurer	L. C. Winkelhaus	E. F. Snyder	E. F. Snyder	E. F. Snyder
Directors	Shirley White	R. D. Hellweg	W. F. Armstrong	J. A. Goforth
	H. M. Wilson	F. W. Hutcheson	J. S. Ellis	E. R. Simmons
	R. D. Hellweg	W. F. Armstrong	J. A. Goforth	N. D. Bryant
	F. W. Hutcheson	J. W. DeValle	E. R. Simmons	A. R. Dahlberg
	W. F. Armstrong	J. A. Goforth	N. D. Bryant	J. S. Ellis
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	1966-1967	1967-1968	1968-1969	1969-1970
President	R. D. Hellweg	J. W. DeValle	W. F. Armstrong	J. A. Goforth
1st V.-Pres.	J. W. DeValle	W. F. Armstrong	J. A. Goforth	A. R. Dahlberg
2nd V.-Pres.	W. F. Armstrong	J. A. Goforth	A. R. Dahlberg	T. L. Fuller
3rd V.-Pres.	J. A. Goforth	A. R. Dahlberg	T. L. Fulle	N. D. Bryant
Secretary	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg
Treasurer	W. H. Huffman	W. H. Huffman	W. H. Huffman	W. H. Huffman
Directors	N. D. Bryant	J. S. Ellis	N. F. Lucas	W. H. Rankin
	A. R. Dahlberg	T. L. Fuller	W. L. Short	E. E. Runde
	H. F. Lucas	R. A. Youngblood	C. E. Wachter	T. A. Reynolds
	J. S. Ellis	H. F. Lucas	A. C. Jones	J. J. Ridgeway
	T. L. Fuller	W. L. Short	W. H. Rankin	J. R. Williams
	R. A. Youngblood	C. E. Wachter	E. E. Runde	J. W. Chambers
	V. D. Raessler	A. C. Jones	T. A. Reynolds	R. E. Frame
	W. L. Short	W. H. Rankin	J. J. Ridgeway	J. C. Hobbs
	C. E. Wachter	E. E. Runde	J. R. Williams	

Inside Hoosac Tunnel during installation of the Armco Liner Plates are (left to right) G. M. SEELEY, Assistant Engineer, and C. D. PIERCE, Supervisor (both of the Boston and Maine's Bridges and Buildings Department); and D. L. HORTON, Armco Sales Engineer.

Steel makes products better for you

Armco Liner Plates reinforce roof of Hoosac Tunnel.

Armco Liner Plates are being used to reinforce the roof and walls of Hoosac Tunnel and thus retard further spalling of the brick lining. The spalling has been quite costly to owners of Hoosac since the route opened in 1876.

Current owners, the Boston and Maine Corporation, kept about 15 maintenance men constantly busy, mostly at Hoosac's west entrance.

The first Armco Liner Plates were installed in 1963. So far about 700 feet of tunnel have been lined. In the just-completed 328-foot section, 3-gage galvanized plates were pre-bolted together and shipped to the tunnel. On-site plate assembly was thus reduced considerably. The horseshoe-shaped lining is 21 feet 5 inches high and 25 feet 2 inches at its widest point.

Even if your lining needs aren't of this magnitude, Armco Liner Plates will still do the best possible job in saving old structures and making new ones more durable.

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ARMCO STEEL ARMCO

CONSTITUTION

ARTICLE I.

NAME

Section 1. This association shall be known as the American Railway Bridge & Building Association.

ARTICLE II.

OBJECT

Section 1.** The object of this association shall be the advancement of knowledge pertaining to the design, construction and maintenance of railway bridges, buildings, water service facilities, and other structures, by investigation, reports and discussions.

Section 2. The association shall neither indorse nor recommend any particular devices, trade marks or materials, nor will it be responsible for any opinions expressed in papers, reports or discussion unless the same have received the endorement of the association in regular session.

ARTICLE III.

MEMBERSHIP

Section 1. The membership of this association shall be divided into five classes, viz: Members, life members, associate, honorary and junior members.*

Section 2.** A member shall be a person in a position above rank of gang foreman in connection with roadway bridge, building and water service work, or in the employ of a public regulatory body, a professor of engineering in a college, an engineering editor, or a government or private timber expert. Any person desirous of becoming a member shall make application upon the form prescribed by the executive committee, setting forth his name, age, residence and practical experience. He shall furnish at least three references to whom he is personally known. Applicants may be voted into membership at any regular executive meeting or by letter ballot of the executive committee, a majority vote being necessary in either instance.

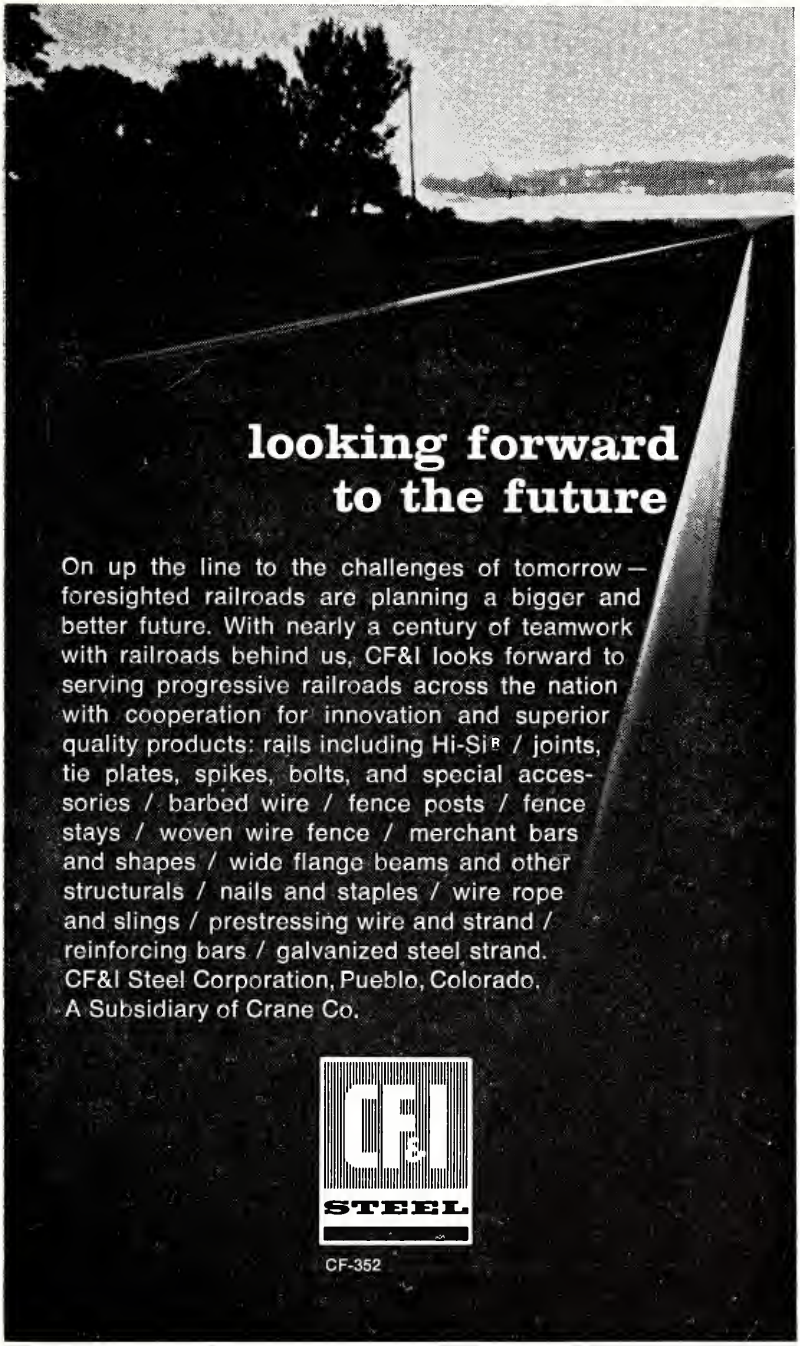
Section 3.** To be eligible for a life membership a member must have belonged to the association for at least 15†† years and in general must have retired from active railway service due to age or physical disability. He shall have all the privileges of active membership, except the holding of office, and shall not be required to pay annual dues. The transfer from membership to life membership shall be made in the same manner as the election of members, as prescribed in Section 2, of this Article.

Section 4. Associates shall be responsible persons who are not eligible as members, whose pursuits or attainments qualify them to co-operate with members in the study and development of improved practices in the construction and maintenance of bridges, buildings and water facilities. They shall have all the rights of members except of voting and holding office. They shall be elected in the manner prescribed for members, in Section 2 of this Article.

Section 5. Honorary members shall be chosen from persons who have attained acknowledged eminence in some branch of engineering or railway service. Their number shall be limited to ten. Honorary members shall be proposed by not less than six active members and shall be elected by the unanimous vote of the members present at a regular meeting. They shall have all the rights of active members except that of holding office and shall be exempt from the payment of dues.

Section 6. A junior member shall be a person who is a graduate of a recognized engineering school, or who has been employed for at least two years in the design, maintenance or construction of railway bridges, buildings or structures. Applicants shall be at least 21 years of age and they shall be elected in the manner prescribed for members, in Section 2 of this article. Juniors shall have all the rights of members except that of holding office. When the attainments of a Junior are such as to qualify him as a member, he may apply for promotion and the executive committee shall authorize such promotion when qualifications warrant the action. Unless a Junior is promoted, his membership shall cease automatically when he becomes 28 years of age.*

* Amended October 16, 1941.
** Amended September 20, 1948
†† Amended March 10, 1958.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Section 7. Any member guilty of conduct unbecoming to a railroad officer and a member of this association, or who shall refuse to comply with the rules of this association, shall forfeit his membership on a two-thirds vote of the executive committee.

Section 8. Membership shall continue until written resignation is received by the secretary, unless member has been previously expelled, or dropped for non-payment of dues in accordance with Section 1 of Article VII.

Section 9.** Only active members shall hold office in this association, and only active and life members shall be entitled to vote in the election of officers.

ARTICLE IV.

OFFICERS

Section 1§. The officers of the Association shall be a president, three vice-presidents, a secretary, a treasurer and nine directors, who, with the most recent past president, shall constitute the Executive Committee.

Section 2. The past presidents of this association, previous to the most recent past president, who continue to be members shall be privileged to attend all meetings of the executive committee, at which meetings they shall receive due notice, and be permitted to discuss all questions and to aid said committee by their advice and counsel; but said past presidents shall not have a right to vote, unless called upon to fill a quorum.

Section 3. Vacancies in any office shall be filled for the unexpired term by the executive committee without delay.

ARTICLE V.

EXECUTIVE COMMITTEE

Section 1.** The executive committee shall manage the affairs of the association and shall have full power to control and regulate all matters not otherwise provided for in the constitution and by-laws and shall exercise general supervision over the financial interests of the association, and make all necessary purchases and contracts required to conduct the general business of the association, but shall not have the power to render the association liable for any debt beyond the amount then in the treasury plus accounts receivable and not subject to other prior liabilities. All appropriations for special purposes must be acted upon at a regular meeting of the association.

Section 2. Meetings of the executive committee may be called by a majority of the members of the committee, providing 10 days' notice is given members by mail.

Section.3. Five members of the executive committee shall constitute a quorum for the transaction of business.

ARTICLE VI.

ELECTION OF OFFICERS AND TENURE OF OFFICE

Section 1. Except as otherwise provided the officers shall be elected at the regular annual meeting of the association and the election shall not be postponed except by unanimous consent of the members present at said annual meeting. The election shall be by ballot, a majority of the votes cast being required for election. Any active member of the association not in arrears for dues shall be eligible for office, but the president shall not be eligible for re-election.

Section 2.§ The president, three vice-presidents, secretary and treasurer shall hold office for one year and the directors for three years, three directors being elected each year. All officers shall retain their office until their successors are elected and installed. A director elected for a three-year term shall not be eligible to serve two consecutive terms.

Section 3.† The term of office of the secretary and the treasurer may be terminated at any time by a two-thirds vote of the executive committee. Their compensation shall be fixed by a majority vote of the executive committee.

The secretary shall also serve as secretary of the executive committee.

Section. 4. The secretary and the treasurer shall be required to give bond in an amount to be fixed by the executive committee.

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* Amended October 16, 1941.
† Amended September 21, 1957.
§ Amended September 28, 1966.

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ARTICLE VII.

MEMBERSHIP FEE AND DUES

Section 1.† Every member upon joining this association shall pay to the secretary an entrance fee and dues as prescribed by the executive committee. No member in arrears for annual dues shall be entitled to vote at any election and any member more than one year in arrears, may be stricken from the list of members at the discretion of the executive committee.

Section 2.‡ A person stricken from the list of members because of non-payment of dues, upon written application may be reinstated as a member in his former class without loss of privileges, either upon payment of all back dues (which must accompany applicants) or at the discretion of the executive committee voting in the manner prescribed in Section 2, Article III.

ARTICLE VIII.*

LOCAL SECTIONS

Section 1.** Upon the application of ten or more members of the association residing in the same geographical district, or having offices therein, the executive committee shall organize a local section for that district, to which all members in that district shall be eligible. Such local section shall admit to active membership only members in good standing. It shall hold not less than two meetings each year, and shall be governed by such constitution and by-laws not inconsistent with the constitution of this association as the section membership may adopt and the executive committee approve.

Section 2. The parent association shall not be put under any obligation, either financial or in the matter of policy or opinion, by any local section.

ARTICLE IX.

AMENDMENTS

Section 1. This constitution may be amended at any regular meeting by a two-thirds vote of the members present, provided that notice of the proposed amendment or amendments has been sent to the members at least 30 days previous to said regular meeting.

By-Laws

TIME OF MEETING

1.** The regular meeting of this association shall convene annually during the month of September, the exact date to be fixed by the executive committee.

PLACE OF MEETING

2.** The place of holding the annual convention shall be Chicago, Ill.

3. It shall be within the power of the executive committee to change the location or time of the meeting if it becomes apparent that it is for the best interests of the association.

QUORUM

4. At the regular meeting of the association, 15 or more members shall constitute a quorum.

***DUES

5. The annual dues for the fiscal year ending August 31, and payable in advance, shall be as follows:*

Members, $7.00; Associate Members, $7.00; Junior Members, $5.00.

DUTIES OF OFFICERS

6.† The president shall have general supervision over the affairs of the association. He shall preside at all meetings of the association and of the executive committee; shall appoint all committees not otherwise provided for, and shall be ex-officio mem-

† Amended October 17, 1940.
* Article adopted 1922.
** Amended September 20, 1948
‡ Amended September 21, 1957.
*** Amended September 15, 1965.

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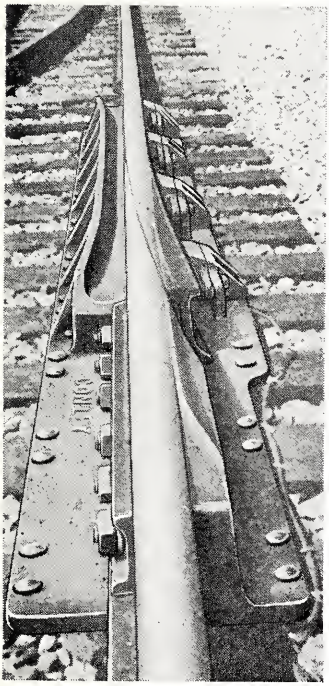

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ber of all committees. He shall with the secretary sign all contracts or other written obligations of the association which have been approved by the executive committee. He shall render a detailed report at least three times during the year to the members of the executive committee, showing the financial condition of the association and its activities.

At the annual meeting the president shall present a report containing a statement of the general conditions of the association.

7. The vice-presidents in order of seniority shall preside at meetings in the absence of the president and discharge his duties in case of a vacancy in his office.

8.† It shall be the duty of the secretary to keep a correct record of the proceedings of all meetings of this association, and of all accounts, between this association and its members; to collect all moneys due the association, and deposit the same in the name of the association. He shall pay all bills when properly certified and approved by the president and the treasurer, and make such reports as may be called for by the executive committee. He shall also perform such other duties as the association may require.

9.‡ The treasurer shall have charge of the funds, check all deposits as made by the secretary, sign all checks after they have been approved by the president, and invest all funds not needed for current expenses as directed by the executive committee. He shall report at each annual meeting on the condition of the finances.

NOMINATING COMMITTEE

10.# After each annual meeting the president shall appoint a committee consisting of five members. Two Past Presidents shall be members of this committee, one of whom shall act as Chairman. No other officers of the Association shall be appointed to this committee. This committee shall prepare a list of names of nominees for officers to be voted on at the next annual convention in accordance with ARTICLE VI of the Constitution, said list to be read at the business session of said convention. Nothing in this section shall be construed to prevent any member making further nominations.

AUDITING COMMITTEE

11.‡ Prior to each annual meeting the president shall appoint a committee of three members, not officers of the association, whose duty it shall be to examine the accounts and vouchers of the secretary and the treasurer and certify as to the correctness of their accounts.

COMMITTEE ON SUBJECTS FOR DISCUSSION

12. After each annual meeting the president shall appoint a committee whose duty it shall be to prepare a list of subjects for investigation to be submitted for approval at the next convention.

COMMITTEE ON INVESTIGATION

13. After the association has adopted the list of subjects for investigation the president for the succeeding year shall appoint the committees who shall prepare the subjects for report and discussion. He may also appoint individual members to prepare reports on special subjects, or to report on any special or particular subject.

PUBLICATION COMMITTEE

14. After each annual meeting the executive committee shall appoint a publication committee consisting of three active members whose duty it shall be to cooperate with the secretary in the issuing of the publications of the association. The assignment of this committee shall be such that at least one member shall have served on the committee during the previous year.

‡ Adopted October 17, 1940.
# Amended December 4, 1950.
† Amended September 20, 1948.
‡ Amended September 21, 1957.

ORDER OF BUSINESS

15.† Call to order by president.
Opening prayer or invocation.
President's address.
Report of secretary.
Report of treasurer.
Appointment of special committees.
Reports of standing committees and presentation of papers.
Unfinished business.
New business.
Election of officers.
Installation of officers.
Adjournment.

DECISIONS

16. The votes of a majority of the members present shall decide any questions. motion or resolution which shall be brought before the association, unless otherwise provided. Unless specifically provided herein otherwise, all discussions shall be governed by Robert's rules of order.

AMENDMENTS

17.† The By-Laws can be amended by a two-thirds vote of those present at any regularly called executive committee meeting.

† Amended September 20, 1948.

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DIRECTORY OF MEMBERS

As of February 1, 1971

HONORARY MEMBERS

Curie, H. D.
Dick, M. H.
Dove, R. E.
Gunderson, R. R.
Howard, N. D.
Jorlett, J. A.
Strate, T. H.
Winkelhaus, L. C.

LIFE MEMBERS

Anderson, Arthur
Anderson, R. D.
Babbitt, J. H.
Baker, F. A.
Baker, R. C.
Beaver, J. F.
Benson, G. W.
Benson, O. C.
Beringer, M. A.
Billmeyer, E. D.
Bishop, D. B.
Block, M.
Brice, W. T.
Buckmaster, W. A.
Budzenski, F. N.
Bunge, W. H.
Burch, E. E.
Burpee, C. M.
Carpenter, R. H.
Carter, J. W.
Christianson, H. B.
Collier, P. B.
Colvin, A. A.
Converse, D. W.
Cramer, F. H.
Cross, E. T.
Cruikshank, A. W.
Davis, H. E.
Decker, H. H.
Dick, H. M.
Duchac, J. V.
Duffie, F. J.
Duresky, Frank, Jr.
Eargle, J. M.
Eichenlaub, C. M.
Elliott, C. E.
Enger, E. M.
Engman, V. E.
Forseth, C. E.
Fox, R. L.
Fronabarger, H. C.
Frost, L. M.
Geyer, C. J.
Giles, J. M.
Hampton, A. A.
Harlow, H. M.
Harman, W. C.
Heck, J. E.
Hedley, W. J.
Heinlen, R. H.
Hemstad, Birger
Hickok, B. M.
Hillman, A. B.
Hoyt, A. C.
Hubbard, M. J.
Hutcheson, F. W.
Hutcheson, W. A.
Hutchings, V. W.
Jackman, H. E.
Jackson, T. E.
Jenkins, H. W.
Johnson, A. C.
Johnson, B. O.
Johnson, E. A.
Johnson, R. W.
Jones, A. C.
Kendal, J. T.
Kemmerer, W. G.
Koehler, P. L.
Krefting, A. S.
Kvenberg, S. E.
Lacher, W. S.
Leach, A. L.
Linn, G. A.
Lokotzke, G. P.
Lord, H. L.
Lucas, H. F.
Luther, L. A.
McDaniel, W. L.
McGrew, F. O.
Manley, B. F.
Martens, W. F.
Mason, S. K.
Mateer, W. G.
Mayfield, Lee
Meeks, W. R.
Merrill, B. W.
Meyers, B. R.
Moore, I. A.
Morgan, C. E.
Morris, R. F.
Mottier, C. H.
Nichols, J. C.
Oest, W. C.
Packard, B. G.
Pahl, W. H., Jr.
Pearson, A. H.
Peterson, N. E.
Pfeiffer, Andrew
Phillips, W. J.
Podas, N. F.
Pritchard, B. L.
Rainey, W. H.
Raver, H. E.
Richards, C. A. J.
Rintoul, D. T.
Robinson, G. E.
Robinson, N. R.
Safley, J. R.
Salmon, J. M., Jr.
Saunders, T. D.
Shobert, Fred
Singer, E. W.
Slagle, G. P.
Smith, C. E.
Smith, E. L.
Smith, J.
Stephens, B. M.
Switzer, G.
Taggart, C. R.
Taylor, W. L.
Thelander, P. V.
Todd, D. C.
Tourtellotte, E. B.
Tucker, N. R.
Tyckoson, E. G.
Varker, J. L.
Von Behren, G.
Wall, R.
Wang, A. B.
Warfield, H., Jr.
Warfield, W. B.
White, L. H.
White, S.
Whitehouse, B. M.
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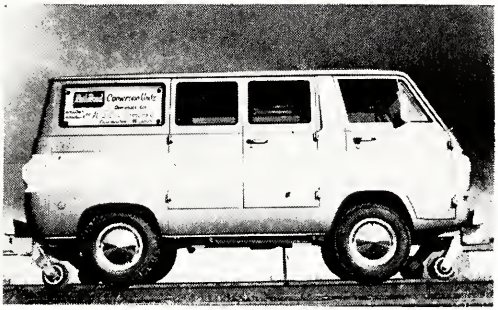

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J " Junior Member
L " Life Member
H " Honorary Member

(Figures following name indicate year in which membership became effective)

A

Abbott, E. L. (M'69), Adm. Secry., A.R.E.A., and Secy. Engr. Div., A.A.R., Chicago, Ill. 60605

Adams, J. H., Jr. (M'61), Ch. Des. Engr.-Bldgs., C.& O.-B.& O., Huntington, W. Va. 25718

Adams, L. J. (M'65), B.& B. Supvr., U.P., Pocatello, Ida. 83201

Ahouse, F. B., Jr. (M'64), Trk. Supvr., Sou., Meridian, Miss. 39301

Albert, E. A. (M'64), Supt. Br. Erec., I.C., Chicago, Ill. 60605

Alderson, A. D. (M'61), Asst. Ch. Engr. Br. & Struc., Soo Line, Minneapolis, Minn. 55440

Alley, F. T. (M'55), Engr. Br., S.P., Houston, Tex. 77035

Anderson, A. (M'47), Ret. Engr. Gr. Cross, N.Y.C., Rosemont Route, Box 56, Colorado Springs, Colo. 80903

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Anderson, R. D. (M'23, L'48), Ret. Div. Engr., C.& N.W., James Valley Nursing Home, Redfield, S. D. 57469

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Aure, T. (M'64), Asst. Engr. Struc., B.N., Glendive, Mont. 59330

B

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Baker, R. C. (M'40, L'68), Ret. Asst. Ch. Engr., C.& E.I., 1655 N. Franklin, Danville, Ill. 61832

Baker, W. F. (A'65), Gen. Mgr., Shelby Precasting Corp., P.O. Box. 13202, Memphis, Tenn. 38113

Barr, A. S. (M'66), Engr. M. of W., P.C., Pittsburgh, Pa. 15222

Barranco, S. J. (M'66), Supvr. Struc., P.C., Pittsburgh, Pa. 15222

Barsema, M. (M'58), B.& B. Supvr., C.& N.W., Chicago, Ill. 60606

Bartley, C. W. (M'66), Engr. Struc., B.N., Glendive, Mont. 59330

Beam, Y. C. (M'45), Mast. Carp., S.C.L., Americus, Ga. 31709

Bean, C. W. (A'64), Mgr. RR Sls., Armco Steel Corp., Metal Prod. Div., 1001 Grove St., Middletown, Ohio 45042

Beard, F. E. (M'65), Supvr. B.& B., W.M., Hagerstown, Md. 21740

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Becker, R. J. (A'69), Dist. Sls. Engr., Lee Turzillo Contr. Co., 33 Kiewit Plaza, Omaha, Nebr. 68131
Beeder, R. H. (M'58), Ret. Ch. Engr. Sys., A.T.& S.F., 1616 Mesa Ave. (Broadmoor), Colorado Springs, Colo. 80906
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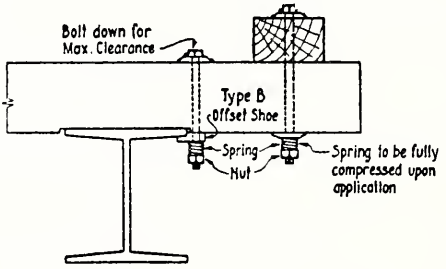

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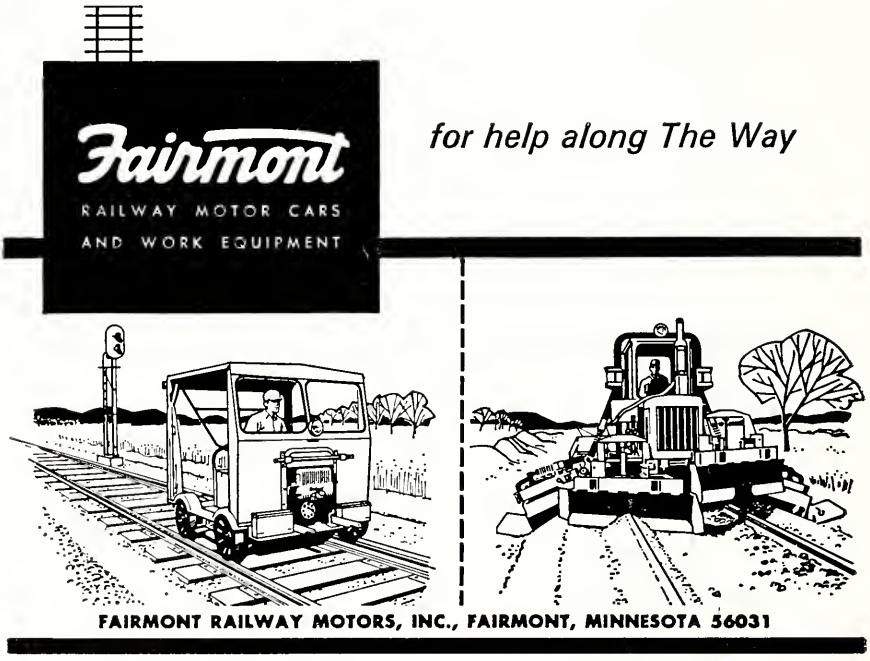

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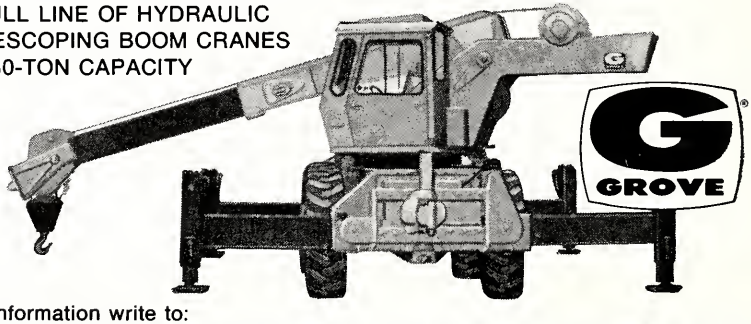

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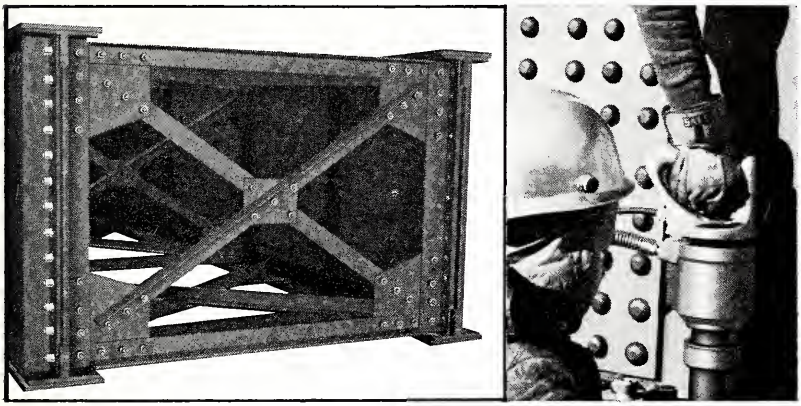

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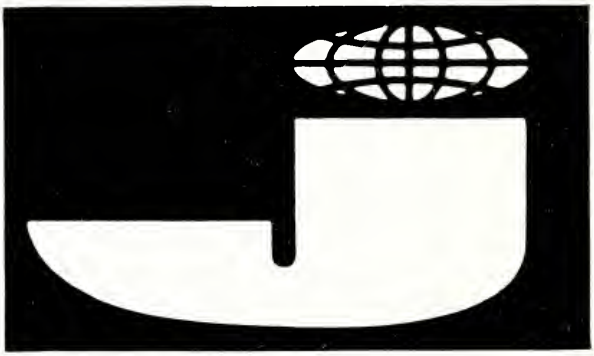

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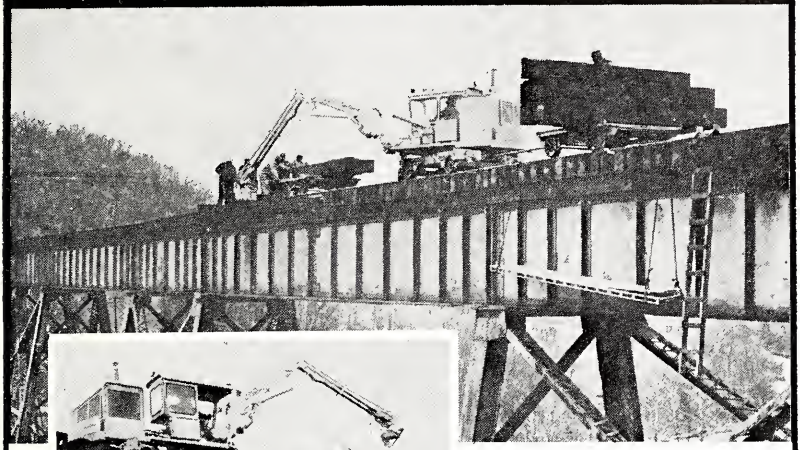

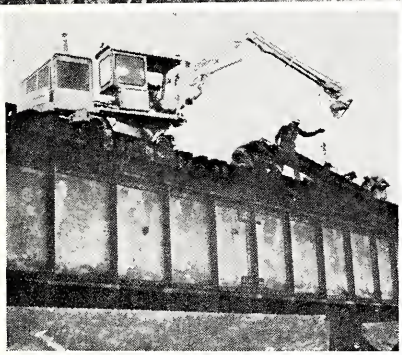

Pictured above — New ties are on the push car behind the crane. Old ties are placed on the push car in front. The Bridge Crane removes old ties and installs new ones by clamping the ends of the ties.

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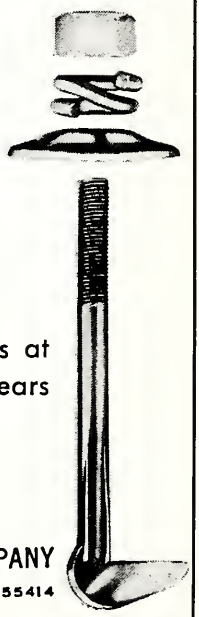

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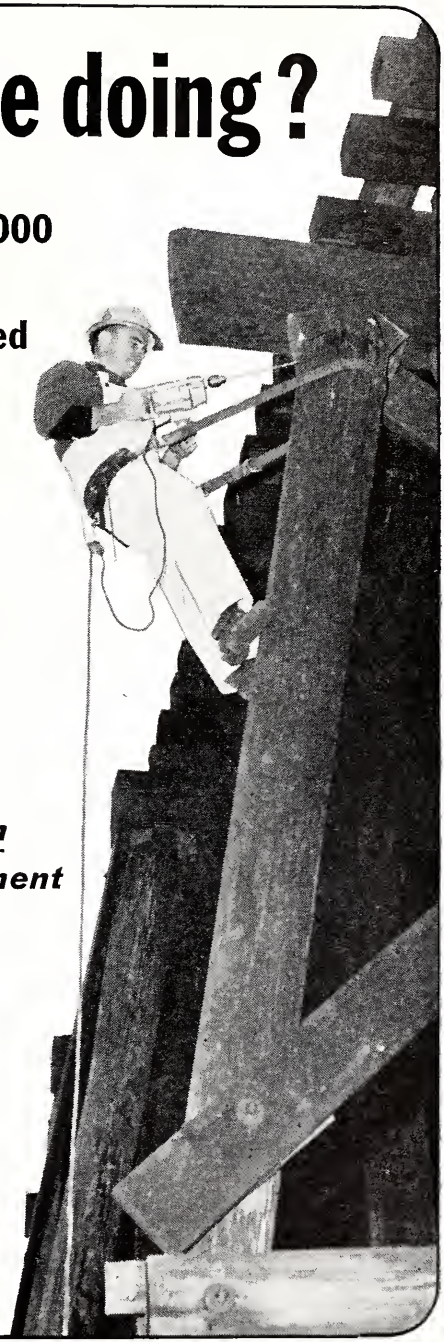

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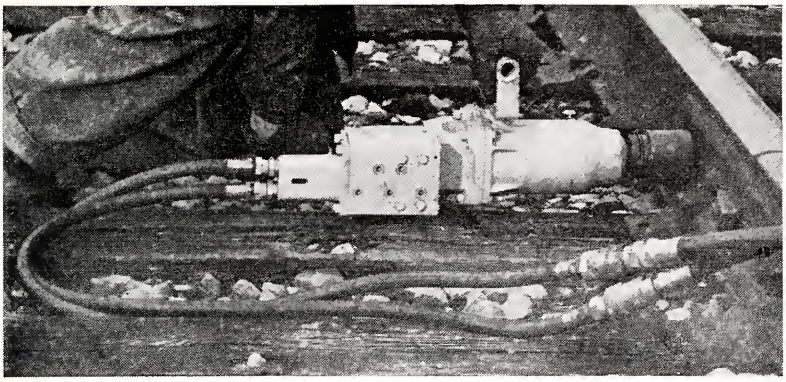

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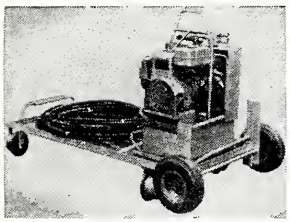

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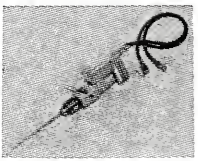

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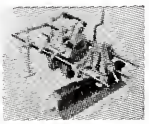

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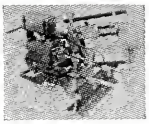

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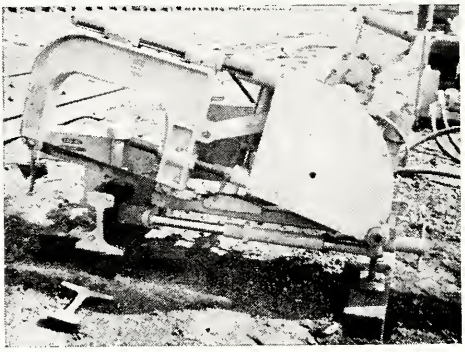

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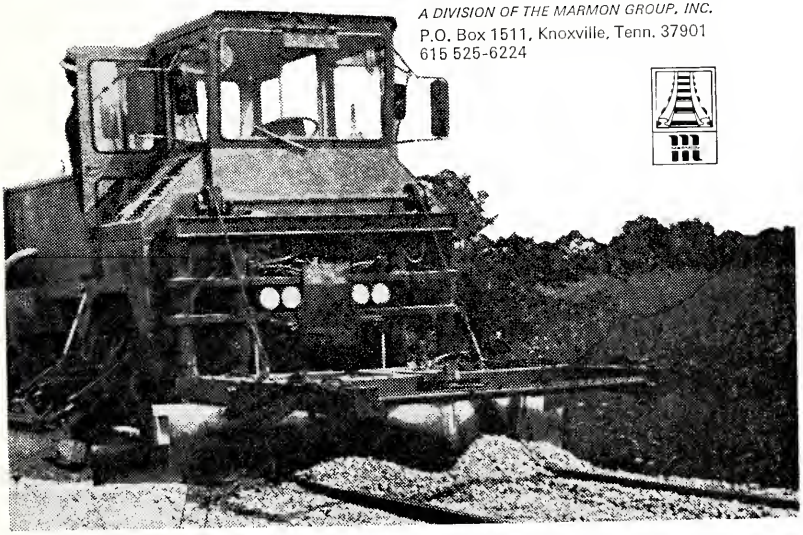

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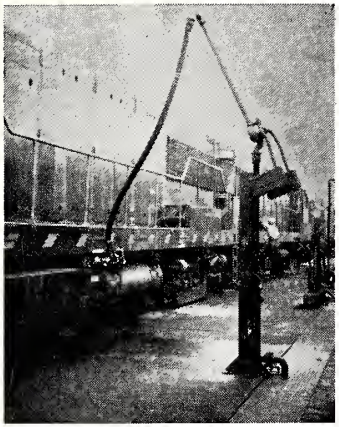
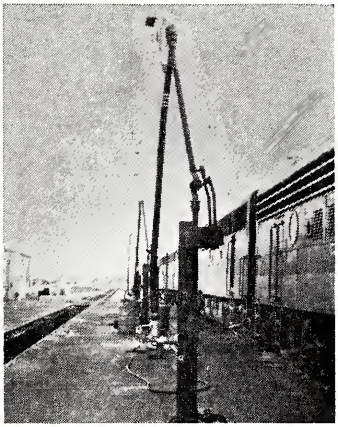
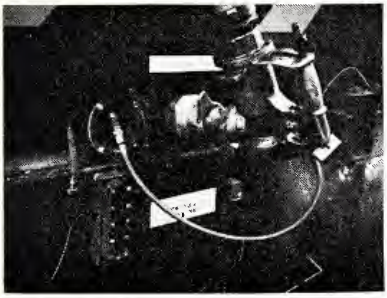


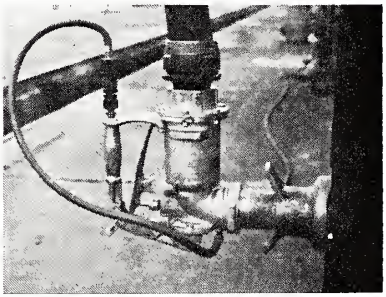
Snyder OPW 1620-DS Automatic Nozzle Fueling on Snyder No. 104-S-2½" Fuel Crane.



Snyder OPW 1620-DS-2½" Automatic Nozzle Secured to Snyder No. 104-S-2½" Fuel Crane.



Close-Up of Snyder OPW 1620-DS Automatic Nozzle in operation, with Snyder No. 565 Quarter Turn Fuel Quick Coupling Adapter, connected to Standard Protectoseal Diesel Fuel Tank. Fill Adaptor.



Close-Up of Snyder OPW 1620-DS Automatic Nozzle secured, with Snyder No. 565 Quick Coupling Fuel Adaptor to No. 104-S Fuel Crane.

The automatic diesel fueling installation pictured above increases safety and efficiency in fueling diesel locomotives because spillage of diesel fuel is eliminated, fire hazard minimized, and water is not contaminated by fuel spillage.

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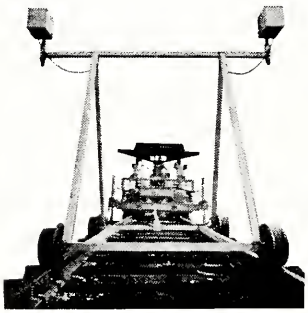

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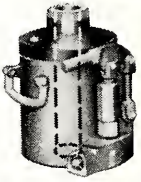

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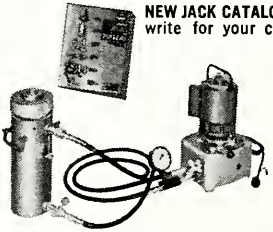

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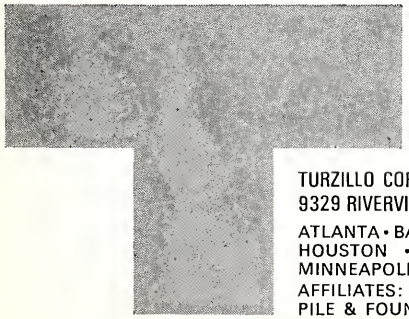

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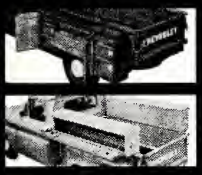

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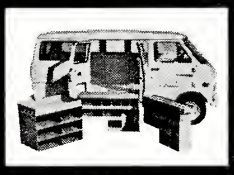

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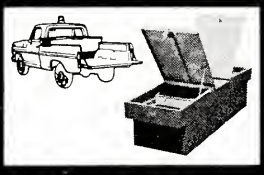

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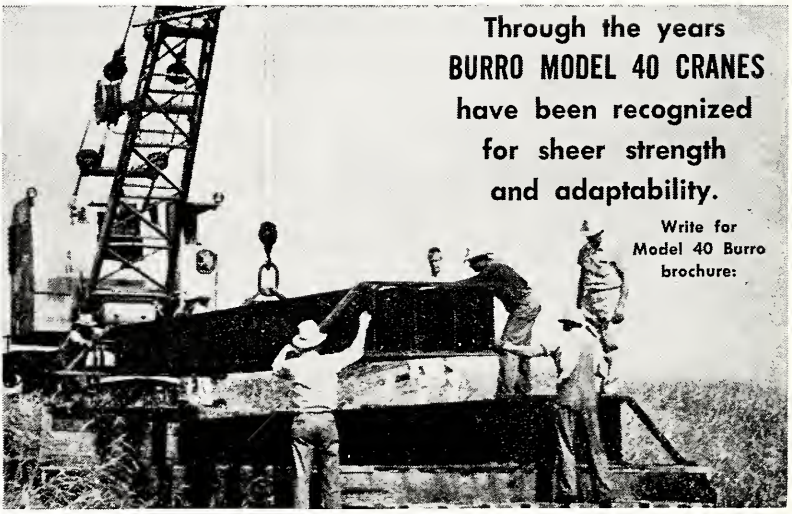

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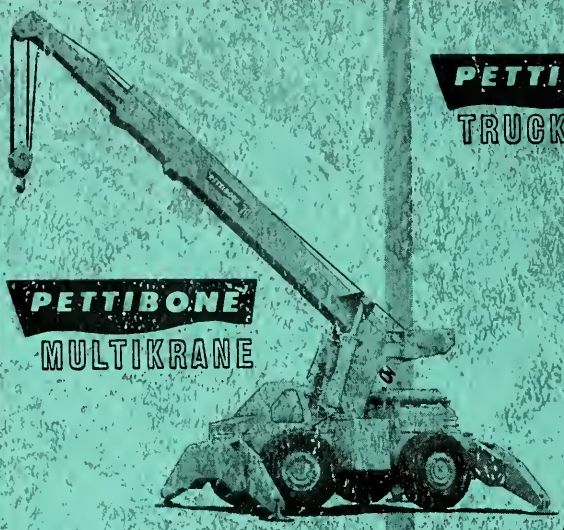

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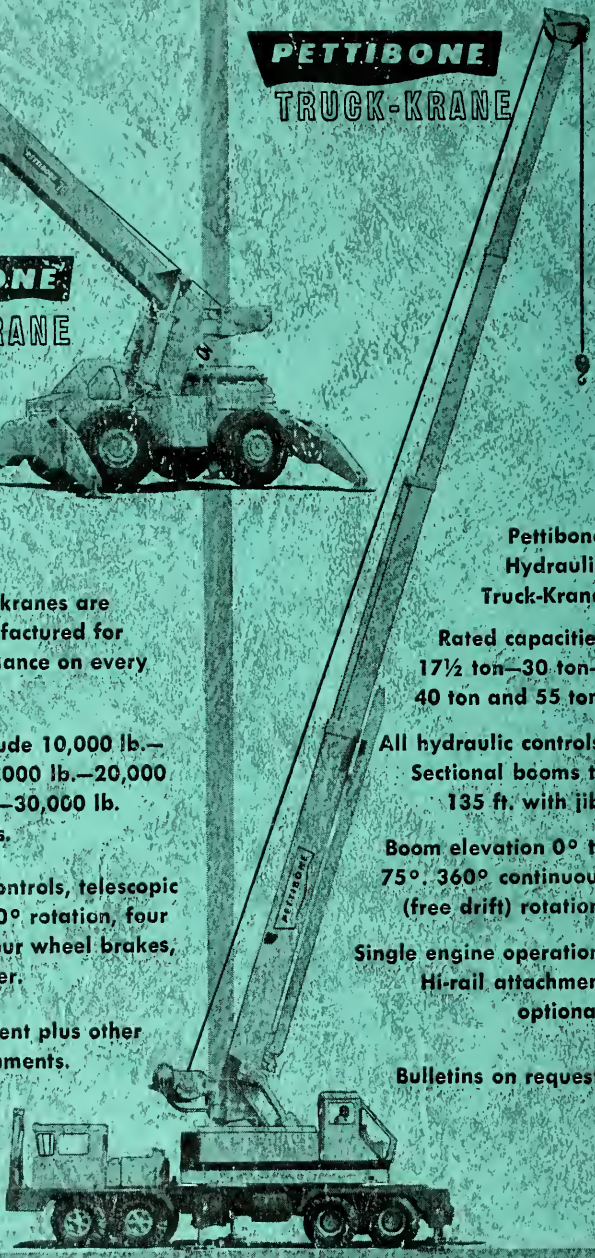

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